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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XXVII

WITH 42 PLATES AND
25 TEXT-FIGURES

1939

ST. LOUIS, MISSOURI

PUBLISHED MONTHLY EXCEPT JULY AND AUGUST,
BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
ONE DOLLAR A YEAR SINGLE NUMBER FIFTEEN CENTS

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Missouri Botanical Garden Bulletin

Vol. XXVII JANUARY, 1939 No. 1

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ONE DOLLAR A YEAR SINGLE NUMBER FIFTEEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING

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Secretary

GERALD ULRICI

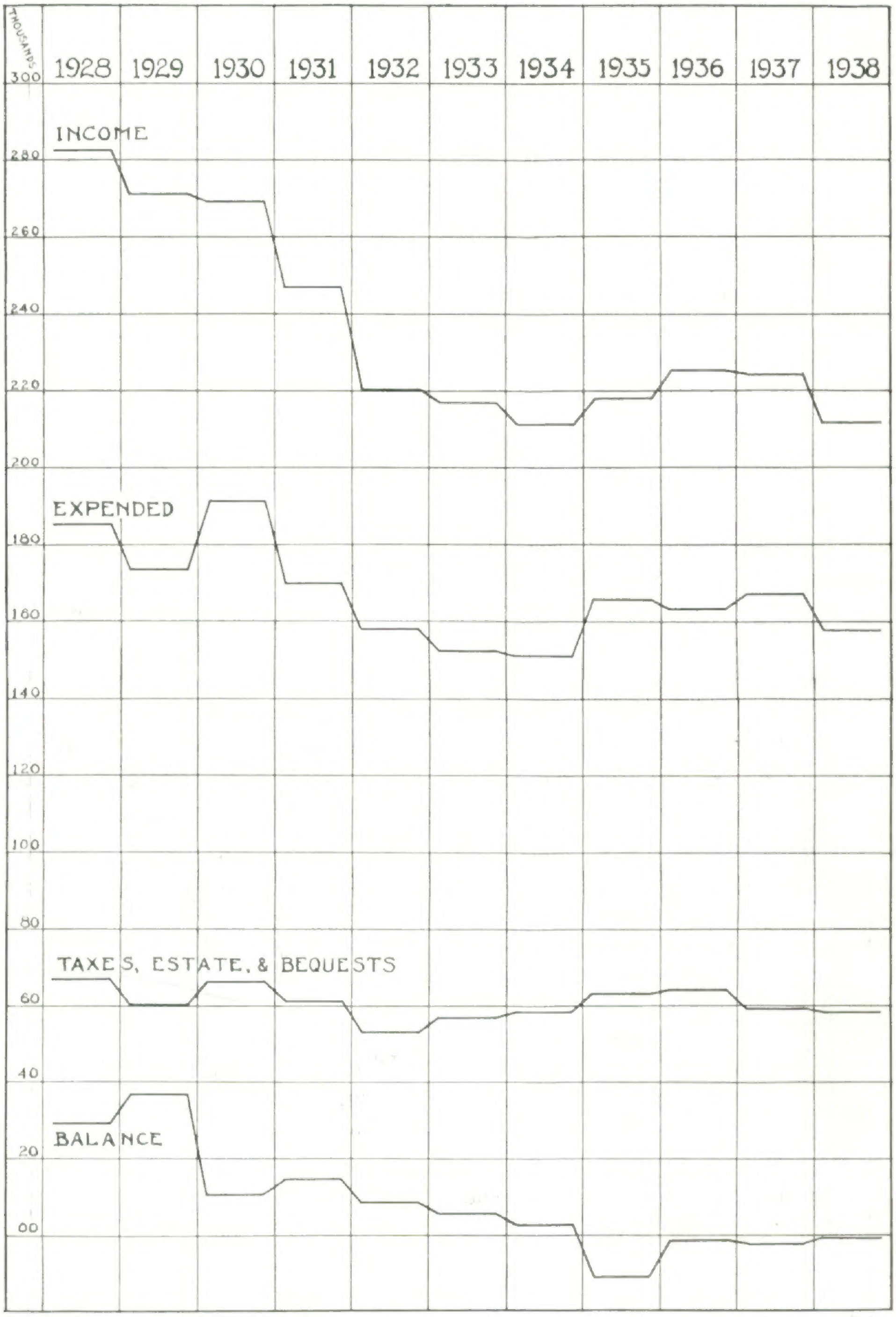
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.



GRAPHIC SUMMARY OF INCOME AND EXPENDITURES FOR PAST ELEVEN YEARS

Missouri Botanical Garden Bulletin

Vol. XXVII JANUARY, 1939 No. 1

FIFTIETH ANNUAL REPORT OF THE DIRECTOR

To the Board of Trustees:

The Director of the Garden has the honor to submit his report for the year 1938.

On August 25, 1889, Henry Shaw died. As soon as the will could be probated, the gentlemen named by Mr. Shaw to constitute the first Board of Trustees met for consultation, and on September 12 Professor William Trelease, the first Director, assumed control of the Garden.[1] Accordingly 1889 is regarded as the year of the founding of the Missouri Botanical Garden as at present organized and administered. It should not be forgotten, however, that as early as March 14, 1859, an act was passed by the Missouri Legislature enabling "Henry Shaw to convey or devise to Trustees certain lands . . . to keep up, maintain and establish a botanic garden for the cultivation and propagation of plants, flowers, fruit and forest trees and for the dissemination of the knowledge thereof among men." It thus becomes evident that while the year 1889 may technically be the date of the founding of the Garden and that its fiftieth anniversary should be celebrated in 1939, Mr. Shaw himself had the idea eighty years ago and definitely provided at that time the legal means of carrying out his project.

The development of the Garden in the first twenty years after Mr. Shaw's death was handicapped by the large amount of unimproved land belonging to the estate, on which the taxes far exceeded any income that could be derived from it. In addition

[1] The Board of Trustees was formally organized on October 14, with Rufus J. Lackland as President and Henry Hitchcock as Vice-President.

to improved real estate east of Grand Avenue, Mr. Shaw devised to the Board of Trustees about three hundred acres of land west of Grand Avenue. This was leased under as favorable terms as could be obtained. The original value of this property was soon eaten up by general taxes alone, as is demonstrated by the fact that in the tenth year after the death of Henry Shaw the entire income from 280½ acres amounted to but $4,197.08, while the annual taxes were $16,743.69, a dead loss of $12,546.61, to say nothing of the hundreds of thousands of dollars assessed against the property for streets, sidewalks, sewers, etc., and the loss of interest on the investment.

Few people realize that it was out of income from the Henry Shaw estate that the improvements were made on most of the land directly east of the Garden, between Tower Grove Avenue and Grand Avenue. To take but a single example: for the improvement of Flora Boulevard and Shaw Avenue, the Garden's share was $147,656.43. During the years 1904-5, $98,199.73 was expended for sewers alone. As late as 1910, taxes, including assessments for streets, sewers, sidewalks, and sprinkling, amounted to $107,026.14, and in the next year they were $108,581.23. It is easy to see how in the fifty years since the death of Mr. Shaw the Garden, out of its income, has paid to the city of St. Louis for general and special taxes, including water cost, over two and one-half million dollars ($2,500,000).

Those who knew the Garden during Mr. Shaw's time remember it with affection, but it is doubtful if they realize the difficulties under which the first Director, Professor William Trelease, labored. In the seventeenth ANNUAL REPORT, for 1906, the Trustees said:

> When the property came under the charge of the Trustees it was a country home on which for some years inadequate expenditure had been made for maintenance. The streets about it were without sidewalks, and the walks within were of such construction as to be impassable in wet frosty weather. The surrounding walls were crumbling, the plant houses were limited in capacity, of antiquated and inadequate construction, and very badly out of repair, while the residence assigned to the Director was found by a committee of physicians to be in a most unsanitary condition, and a little museum that had been maintained for many years had so deteriorated under the care of household servants that the Director was advised to close it. The provision of room for administration, library, herbarium and research purposes also confronted the Board

as an immediate necessity, as did provision for a supply of city water, improvement of existing temporary sewers, and some arrangement other than open grates for heating the residence and museum building.

In spite of the limited amount available for the Garden after general and special taxes were paid, Director Trelease accomplished during the twenty-three years of his administration many important achievements. The removal of Mr. Shaw's town house from Seventh and Locust Streets to the Garden, as provided for in his will, took place in 1891 and immediately furnished much-needed space for offices, the library, and herbarium. The stone cottage at the Cleveland Avenue gate was built in 1895, and the next year Olmsted, Olmsted & Eliot was commissioned to prepare general plans for the improvement of the Garden, including details for the planting of a proposed North American synoptical flora. Not until 1900 was it possible to acquire the twenty acres, south of the original forty acres of the Garden, needed for this development. During this period the plant collections were being increased, the growing of water-lilies (Nymphaeas and Victorias) was begun, the chrysanthemum show became an annual feature, the plant houses were being added to, and in many ways the Garden became more and more attractive, and more widely known as a botanical center.

Perhaps most important of all, the library and herbarium were not neglected. Great credit is due Professor Trelease for the way in which these two fundamental features of a botanical garden were built up. It was during his administration that completing parts of the superstructure were built upon the foundation already laid by Henry Shaw, so that today the library and herbarium of the Garden are universally recognized as outstanding. In this connection, Dr. E. Lewis Sturtevant's gift, in 1892, of a large collection of pre-Linnaean books should not be forgotten.

One might say that it was not until twenty years after Mr. Shaw's death that the Trustees could see the end of the heavy load of special taxes and begin to plan for some real developments at the Garden. In 1909 the large addition to the old Henry Shaw town house was finished, thus providing laboratories and adequate space for the expansion of the herbarium and library. In the same year a plant physiologist was appointed to the scientific staff. In 1911 plans for the erection of the present main conservatories

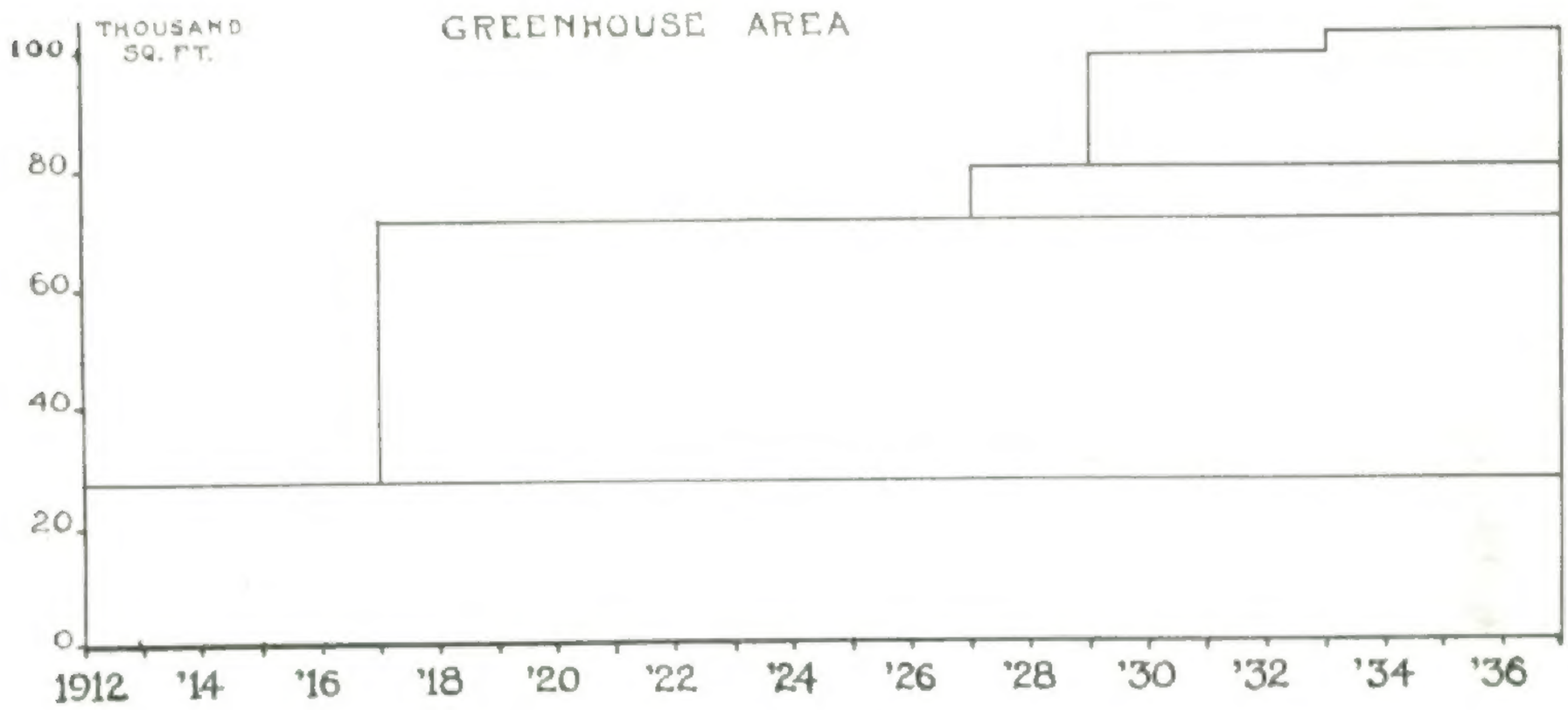


Fig. 1. Area in greenhouses.

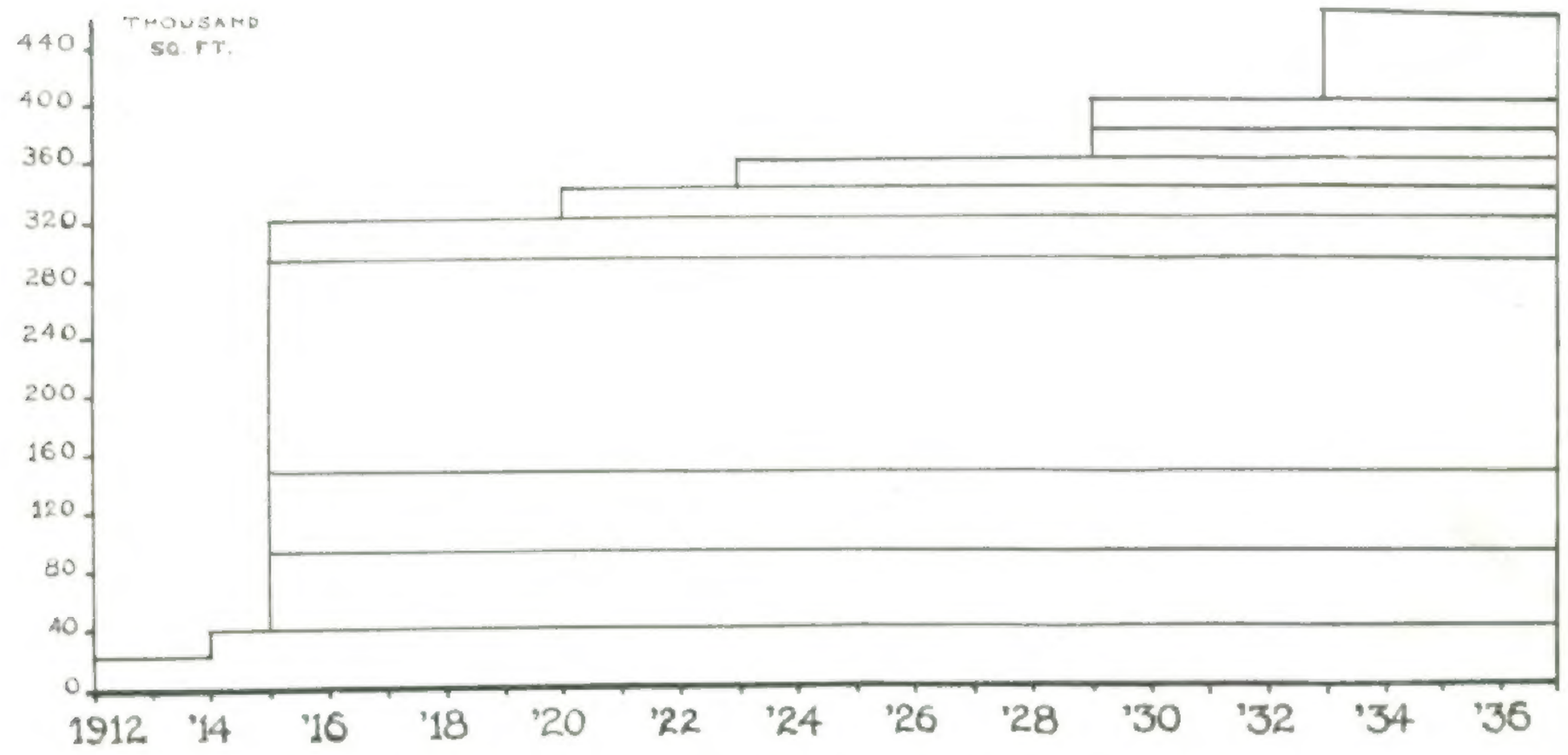


Fig. 2. Outdoor gardens and special plantings.

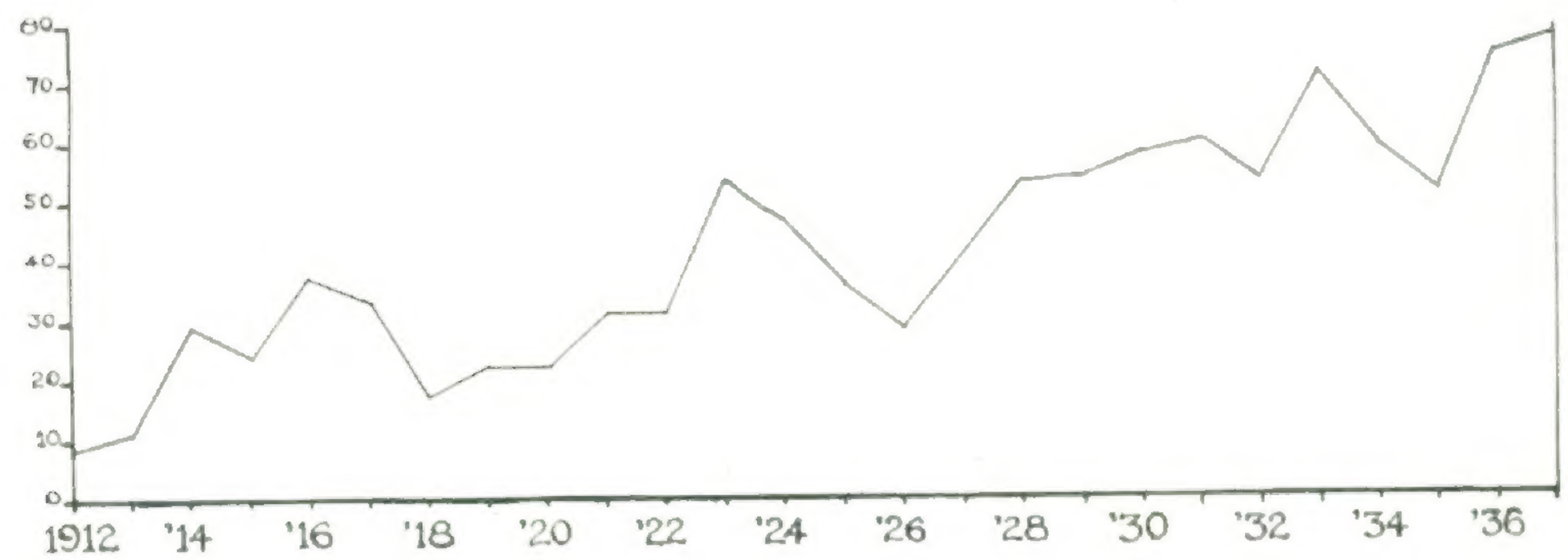


Fig. 3. Number of public lectures given by members of the staff.

were completed, and for the next twenty years, as money became available, one improvement after another was made.

The first scientific paper to appear as a Missouri Botanical Garden publication was by Professor Trelease, on "A Revision of the American Species of *Epilobium* Occurring North of Mexico" in the second ANNUAL REPORT, for the year 1891. Valuable contributions to botanical knowledge by Professor Trelease and others continued to be brought out in the ANNUAL REPORT until this publication was discontinued in 1912, the year of Professor Trelease's resignation as Director.

The new Director assumed office on May 1, 1912. As indicated by the enlargement of the administration building, including the herbarium and library, in 1909, and the letting of the contract for the main conservatories in 1911, funds were at last becoming available for the material expansion of the Garden and its activities. Some of the principal events and physical additions during the second period of the Garden's development are listed by years below:

1912—Central heating plant installed, replacing fourteen separate fires.
North wing of main conservatories completed, and chrysanthemum show held under glass for first time.
Rose garden planted on site of old vegetable garden.
Two new propagating houses erected.
Central telephone exchange installed.
Bubbling fountains for drinking replaced old wells.
New benches and new signs provided for convenience of visitors.
Garden opened on Sunday afternoons from April to December.

1913—First volume of MISSOURI BOTANICAL GARDEN BULLETIN published.
Stone wall and iron fence continued along Tower Grove Avenue to Magnolia Avenue.
Iron fence erected along Magnolia and Alfred Avenues.
New residence for Director built.
Main conservatories completed, opened Sunday, November 16.

New growing-house erected, and many changes made in old greenhouses.
Main garden re-landscaped to conform to new conservatories.
Monthly floral displays inaugurated.
Present Economic Garden begun.
Curator of the Herbarium and Mycologist to the Garden appointed.
Attendance more than double that of 1911.

1914—Celebration of twenty-fifth anniversary of organization of the Missouri Botanical Garden.
New quarterly journal ANNALS OF THE MISSOURI BOTANICAL GARDEN inaugurated, replacing the ANNUAL REPORT.
New propagating house erected.
Plant pathological exhibition installed in old Museum.
Extensive improvements in outdoor planting, formal garden bounded by the new conservatories, English garden, the knolls, establishment of a nursery, etc.
School for Gardening reorganized.

1915—Second range of greenhouses completed, including Floral Display, Aroid, Bromeliad, and eight growing-houses.
Experimental greenhouses, near administration offices, built.
First gift of plants, including orchids, from Mr. D. S. Brown.
Representative collection of Wilson and Purdom plants from China received through Professor C. S. Sargent of the Arnold Arboretum. From New York Botanical Garden and Garfield Park, Chicago, valuable additions to the aroid collection for the new display house. Month of December included in Sunday opening.

1916—Removal of old range of greenhouses, including old Palm House, north of the water-garden.
Re-erection of part of old range, back of north wall, to furnish additional growing and propagating space.
Paint and carpenter shops, also two brick storage sheds, built near heating plant.

Damage from hail storm in June and wind storm in September.
Grading and partial landscaping of new economic garden, on site of old herbaceous tract.
Retaining wall, stairway, and pergola built west of Italian Garden.
Shakespearean garden installed in Floral Display House, during convention of Drama League, celebrating three-hundredth anniversary of Shakespeare's death.
Sunday opening extended to include every month in the year.
Cellar, heating system, electric lights, bathroom, etc., provided at Cleveland Ave. gate-house.

1917—Regrading and landscaping of main garden between Entrance and Palm House.
Building of concrete pools for water-lily display.
Construction of many new walks and drains.
New rose garden established south of Linnean House.
Completion of Economic Garden, including walks, steps, back-yard gardens, cordon fruit trees, and general planting.
Grotto and permanent bridge installed in Fern House.
Engineer's house erected on Shaw Avenue.
Building of coal-storage bin, capacity of 1000 tons.

1918—War. Facilities of Garden offered to Government.
Fifteen employees and Garden students given leave of absence. Remaining members of staff associated with Council of National Defense, Raw Products Committee, Food Administration, etc., in solving specific problems concerning military and commercial affairs.
Opening of Red Cross surgical dressing shop and packing room.
Old residence of Henry Shaw sand-blasted and stuccoed.
Wooden bridge in North American Tract replaced by stone and concrete structure.
Additional gift of orchids and other plants by Mr. D. S. Brown.
School for Gardening closed, floral displays abandoned, and many usual activities suspended.

1919—Effect of war still evident in curtailment of activities and depleted income.

Reconstruction of Linnean House, including new roof and new heating system, and rearranging and replanting interior.

Two new propagating and growing-houses built.

Completion of concrete heating tunnel, 6 × 7 × 175 feet.

Test garden for growing interesting novelties and new varieties of plants.

Native wild flower collection established west of the pergola.

Vocational training for soldiers undertaken, under the auspices of the Federal Board for Vocational Education of Disabled Soldiers.

School for Gardening reopened. Arboriculturist and Landscape Designer added to staff and changes made in positions of Horticulturist and Floriculturist.

St. Louis meeting of American Association for the Advancement of Science, in which the Garden took an active part.

1920—Construction of new main entrance begun.

Over a mile of fencing erected around unfenced portion of Garden.

Two additional propagating and growing-houses built.

Additional concrete heating tunnel completed.

1921—Dedication of new main entrance, May 10, the Honorable Henry C. Wallace, Secretary of Agriculture, delivering the address.

Completion of stone wall between service yard and main garden, and two stone posts from old Vandeventer Avenue entrance installed.

Building of brick head-house, east of new growing-houses.

Geneticist appointed to staff.

1922—Reproduction of old Chelsea Physic Garden for meeting of American Medical Association.

Reorganization of School for Gardening.

Sprinkling system installed in Rose and Perennial Gardens.

1923—By Court decree, permission granted to the Trustees to dispose of pasture land west of the Garden; the proceeds to be used "for the purchase of such additional tracts of ground away from the atmospheric influences of the city, sufficiently far to successfully carry out the objects of said trust in the propagation and growing of plants, shrubs, flowers, etc., as set out in the will of Henry Shaw, deceased, including the erection of necessary equipment and improvements thereon."

Plans prepared and improvements begun on "Henry Shaw Subdivision."

Expedition to Central and South America for orchids.

Iris and peony collection established in Linnean House Garden.

Test plots for various grass mixtures to use on lawns and golf links.

Building of house at Alfred and Shaw Avenues, for night engineer.

1924—Sale of lots in new subdivision justified active search for out-of-town location.

Destructive storms and abnormal weather conditions marked the year.

Heavy freeze in January, following a period of high temperature, most destructive. On April 8 occurred the worst hailstorm ever experienced at the Garden. Two thousand lights of glass were broken and plants were greatly injured by falling glass. A severe windstorm on July 17 wrecked 150 large trees, so that their removal was necessary. On October 25, 26, and 27 an unusual smoke cloud hung over the Garden, greatly damaging greenhouse plants. On December 8 the Garden was visited by an ice storm which completed the destruction of many trees and shrubs which had survived the wind-storm of July. Because of destruction from storms, much replanting necessary.

English perennial border established and iris collection increased to 300 varieties.

1925—Purchase of what was then called "out-of-town extension of the Garden," consisting of 1300 acres.
Final settlement of "Two-hundred-foot strip" matter.
Construction of 500 feet of concrete tunnel for heating pipes.
Surfacing, for the first time, of all walks with oil and tarvia.

1926—Purchase of 323 acres on south side of Meramec River, to protect property on opposite bank.
Completion of eight greenhouses at the "Extension" for housing orchid collection.
Removal of orchids from the city to new range.
Powell collection of orchids presented to the Garden.
Land for a tropical station, at Balboa, C. Z., acquired through Canal Zone Government. Orchidologist added to staff.
On November 12 Queen Marie of Roumania visited the Garden, and a bouquet of orchids was presented to her that evening.

1927—A repetition of the adverse weather conditions of 1924, only to a much greater degree. The record hailstorm of May 28 did $50,000 worth of damage. A windstorm early in May, together with the cyclone of September 29, destroyed or damaged between 400 and 500 trees. On Christmas day, the entire city was enveloped in a smoke cloud such as had never before been experienced, and practically all the plants in the greenhouses were injured, some of them seriously.
House on "Two-hundred-foot strip" purchased from City and moved to corner of Magnolia and Alfred Aves. for Superintendent's residence.
Building of house at Balboa, C. Z., for resident manager of Tropical Station.
Motion-picture studio established.
Grading, road building, construction of stone wall, repair and renovation of brick farm house, etc., at Gray Summit Extension.

1928—Appointment of European Representative of Garden.
Apprentices replaced former School for Gardening pupils.
Development of orchid-seedling project.
Iris test garden established.
Old growing-houses back of the wall abandoned and wrecked.
Continued construction of roads and development of nurseries at Gray Summit Extension. Furnishing of administration building.

1929—Opening of Henry Shaw museum in old Shaw residence.
Elimination of open ditch at western side of Garden, nearly 1,000 feet of 36-inch drain tile being used in new drainage.
Completion of new cold-storage house.
Resurfacing of 13,000 square yards of walks.
Number of seedling orchids increased to about 50,000.

1930—Celebration of three-hundredth anniversary of the first recognized use of Cinchona.
Seed of "lost" tropical yellow water-lily secured.
Restoration of "Museum and Library" building.
Three additional growing-houses erected.
First prize awarded the Garden by American Orchid Society, Washington, D. C., for exhibit illustrating the development of orchids from seed.
Addition of three greenhouses to orchid range at Gray Summit Extension.

1931—Creation of *Nymphaea* "St. Louis."
Collection of Philippine orchids given by Hon. Dwight F. Davis.
Office facilities furnished St. Louis Horticultural Society.
Celebration of the one-hundredth anniversary of the birth of Julius Sachs, famous German plant physiologist.

1932—Striking of the "Henry Shaw Medal."
Planting and developments at the "Gray Summit Extension" warranted the change of name to "Missouri Botanical Garden Arboretum," now its official designation.
Extensive changes and improvements at Tropical Station.

1933—Four special exhibits made at National Flower Show.
"Plant Curiosity" display established.
Iris Garden remodeled and enlarged.
New storage bins for potting soil, leaf-mold, compost, etc., and soil-shredder constructed.
New dam at west end of lake in North American Tract.
Discovery of the native habitat of *Sobralia Powellii*.

1934—Graphic record of drop in funds available for Garden, from $215,288 in 1928 to $148,461 in 1934.
Camp for unemployed young men established at Arboretum in cooperation with the Citizens' Committee on Relief and Employment.
Through action of courts of Franklin and St. Louis Counties, that part of Highway 66, from the city limits to the entrance of the Arboretum, designated as the "Henry Shaw Gardenway."
Display house for orchids at Arboretum doubled in size.

1935—Placing of bronze tablets at main entrance and on various historical structures associated with Mr. Shaw.
Resurfacing 2½ miles of walks, with necessary changes in drains and catch basins.
Replacing mules with tractor and trucks. Old stable converted into garage.
South African House planted.
Sir Jeremiah Coleman collection of blooming orchids shipped for display by Garden at Greater St. Louis Flower and Garden Show.
Award of Henry Shaw Medal to Sir Jeremiah Coleman.
Dedication of five tablets, marking significant points along Henry Shaw Gardenway.

1936—Completion of lodge and rest-rooms at what will be the main entrance to the Arboretum.
Record broken for prolonged and extreme cold as well as for prolonged and extreme heat and drought.
Extensive repairs on greenhouses, now twenty-five years old.

1937—Rebuilding of roof and side frames of Floral Display House.

Installation of irrigating system, water supplied from lake.
Supervised instruction for school children, in cooperation with the Board of Education.
Special exhibits and demonstrations for members of the Garden Club of America, meeting in St. Louis.
Extensive improvements under new management, of the Tropical Station.
1938—See extended reports from various departments in this Report, pp. 29-48.

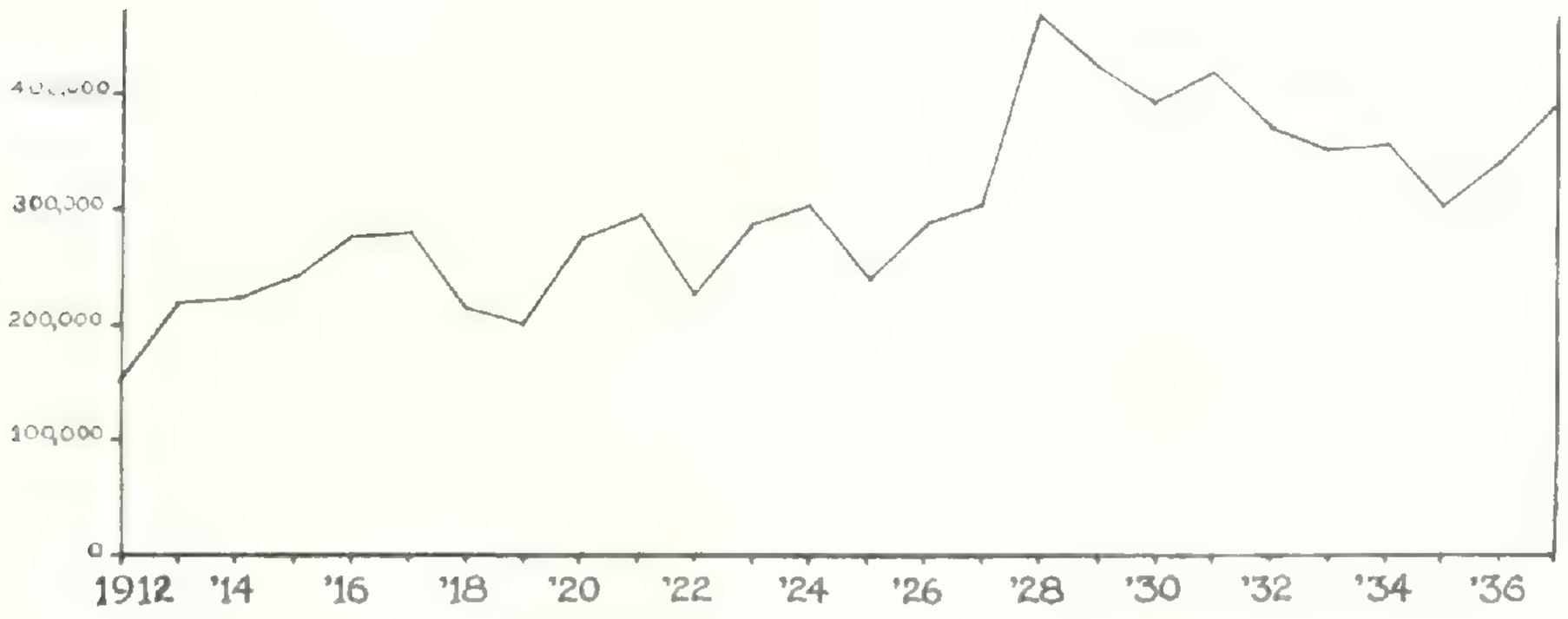


Fig. 4. Attendance.

No attempt has been made to list the additions to the herbarium and library from year to year. That these important adjuncts to a botanical garden have not been slighted is indicated by the accompanying charts (fig. 5). Due chiefly to the great increase in the number of orchids, the value of all the plants grown under glass has more than quadrupled in the last twenty-five years. In the same period more than $542,000 has been expended out of income for permanent improvements, such as new greenhouses, heating plant, residences for employees, etc. The cost of the land, greenhouses, heating plant, and other improvements at the Arboretum at Gray Summit was not borne out of income. A special fund, derived from the sale of lots in the Henry Shaw subdivision, was designated by Court order for this purpose.

It is fair to say that, based on any system of accounting which might be applied to any commercial concern, the physical assets of the Garden, as expressed in buildings and collections, have steadily

increased since the death of Mr. Shaw. Likewise the less tangible, but equally as important, scientific, educational, and cultural aspects of the Garden have not been allowed to suffer. Could Mr. Shaw return to his Garden today, he might be surprised at how little of the income from his estate was available for garden maintenance and improvements, but he could not but be gratified at the substantial way in which his dream of eighty years ago had materialized.

The high place the Missouri Botanical Garden has come to hold in the estimation of the community was recently demonstrated to an unusual degree. An announcement in the press that the income from the Henry Shaw estate had decreased to a point where it might become necessary to abandon or curtail some of its activities, brought an immediate response. The following editorials probably express as well as anything could the feeling of the people of St. Louis and vicinity for "Shaw's Garden."

Shaw's Garden Income Inadequate. The Missouri Botanical Garden—more familiarly known and referred to as Shaw's Garden—has unique standing among public institutions in St. Louis as well as among important botanical gardens of the world. Its income which is derived entirely from the Shaw estate is sharply reduced by taxation while other city institutions and other great botanical gardens are supported out of tax funds.

In fact, estate taxes and the cost of garden management have mounted so steadily against the current of declining estate income that in recent years necessary economies have reached the point of threatening maintenance of the institution along the lines of original design. As explained by Dr. George T. Moore, the director, the garden, which is a public charitable trust created under the will of Henry Shaw, although an outstanding civic asset of St. Louis, is not granted any public funds, either city, state, or federal, and must maintain itself. He says it is the only great botanical garden in the world which, instead of being supported by taxation, actually pays taxes. That the item is of crippling importance is to be seen in the fact that more than $2,500,000 has been paid in taxes, including regular and special assessments, since the death of the donor in 1889.

So with mounting taxes and costs of maintenance operating against a declining gross income, the annual income last year was $50,000 less than it was in 1928, and an additional decrease of $1,000 a month for the current year is anticipated.

While no immediate campaign for raising money or endowment is contemplated at this time, the management suggests the thought that such a procedure may offer the only solution short of a discontinuance of certain services which are vital to the public good and a foreshortening of long-time plans for the continuing development

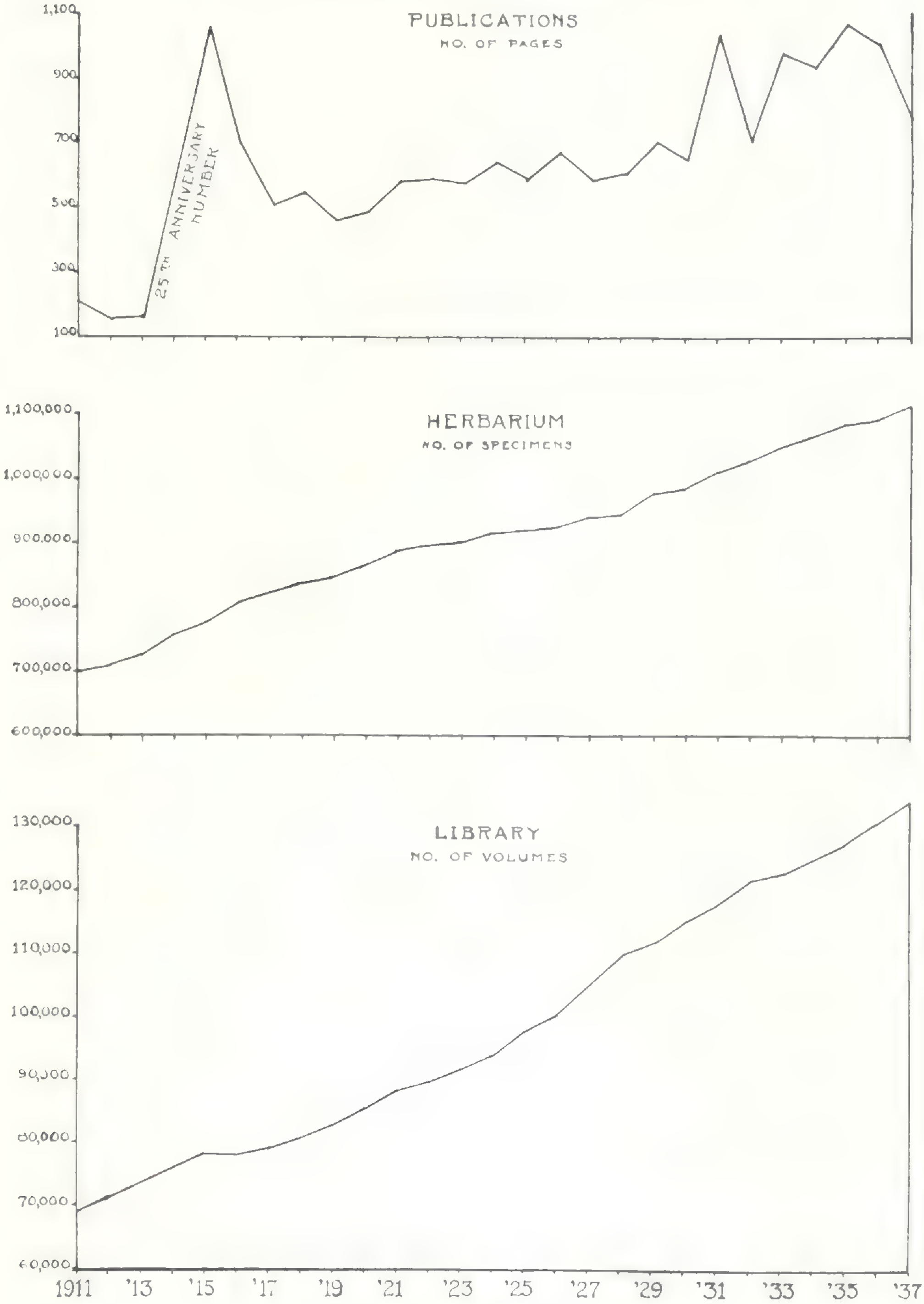

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Fig. 5.

of the garden in St. Louis and the progress of the 1600-acre arboretum at Gray Summit, which original plans intended for public enjoyment on even terms with the older compound adjoining Tower Grove Park, which was also a Henry Shaw gift to the public.

Meanwhile an admission fee to Shaw's Garden is being contemplated to repair the financial crisis, in company with abandonment of certain activities and curtailment of further improvements at the Gray Summit arboretum. This turning back would be unfortunate. Response to the suggestion from Dr. Moore, that gifts from the public and enlargement of endowment would be welcome, would be the better way, provided no way can be found to relieve a public institution of taxes which restrict its activities for the public good.

Globe-Democrat, June 14, 1938.

Shaw's Garden. It is a source of regret to learn that a decrease in the annual income of Shaw's Garden threatens immediate and drastic curtailment of the garden's activities. With the Municipal Opera and the Zoo, the Missouri Botanical Garden enjoys a world-wide reputation and compares favorably with the famous Kew Gardens of London.

Few St. Louisans realize that of the outstanding gardens of the world Shaw's Garden is alone self-supporting. The British Government supports Kew Gardens. The Berlin and St. Petersburg (Leningrad) gardens are institutions of the German and Russian governments respectively. The Brooklyn and the New York botanical gardens are supported by taxation.

Ironically, Shaw's Garden not only supports itself but, as Dr. George T. Moore explains, it has paid St. Louis more than $2,500,000 in taxes since the death of the founder, Henry Shaw, in 1889.

Under the circumstances it seems more than fair that the city should co-operate with the garden in helping it out of its difficulties. A practical step in that direction would be the elimination of the tax burden.

In these days the hazards of capitalism make it virtually impossible to leave large trust funds for a designated cause and expect the wishes of the donor to be carried out in perpetuity. With rising taxes and a falling off of revenue from investments the executors of these trusts are hard pressed to make both ends meet. Shaw's Garden is an example brought home to all St. Louisans who have enjoyed its benefits without being asked for a penny in return.

Star-Times, June 15, 1938.

Shaw's Garden in Need. Great paintings should not be measured in terms of monetary value, and neither should the dollar be the unit for scaling the worth to a community of an institution like the Missouri Botanical Garden. And yet it obviously costs a great deal to keep up so magnificent a civic asset, and the management must necessarily hold a close watch on income and disbursements. It is eminently in order, therefore, that Dr. George T. Moore, the garden's director, and its trustees should have decided to inform the public, which they have served so generously, of the present financial plight of the garden.

The garden has always been maintained on a most unusual basis.

Established by the will of Henry Shaw, English-born merchant in pre-Civil War St. Louis, it has been kept up by the income from his estate. This estate has been invested in realty, stocks and bonds. The return from the real estate has been reduced in recent years through lower rents, and the portion of the estate in securities has been similarly affected. In 1928 the gross earnings were about $250,000. Last year the return amounted to about $200,000, and a further decrease to about $188,000 is expected this year.

All the while its revenues have been going down, the garden has continued, as it always has, to help keep up the other civic institutions—schools, Zoo, City Art Museum, hospitals—through the payment of taxes. Kew Gardens are supported by the British Government, the Berlin Garden by Germany, the New York Botanical Garden by New York City. The Missouri Botanical Garden has never had financial support by the taxpayers of St. Louis or Missouri. On the contrary, about one-fourth of its disbursements each year go to pay taxes, insurance costs and other fixed charges.

It is inconceivable that so distinguished a member of the family of civic institutions should be forced to curtail its services to the St. Louis area. Its monthly shows, its research, its publications, its schools and its lectures, above all its continuous presence as a place where individuals and groups can find deep pleasure and rest and inspiration, go to make up something which should be expanded from year to year, certainly not restricted.

It would seem that the mere announcement of the situation should be enough to bring the additional means which are needed to offset decreasing revenues. *Post-Dispatch*, June 16, 1938.

The chart (plate 1) will indicate at a glance what has been happening to the income of the Garden during the past ten years. Since the money available for all Garden activities in 1938 was, we hope, at an unusually low figure, it perhaps would be fairer to take the year 1937 as an example of where the money goes. An itemized account, as prepared by the Board's auditor, is of no value to anyone unfamiliar with the details unless it covers a number of years. This is because the cost of indispensable items varies greatly from year to year. For instance, the expense for fuel may be as low as $8,000 annually, or as high as $12,000, depending on the current price and the weather. The same variation may occur in what is paid out for water, repairs, and similar items which cannot be estimated at the beginning of the year. Except for a total, which may not be exceeded, no itemized budget can be maintained. A particularly cold winter, an unusually dry summer, a hail storm, or unexpected repairs to the heating plant will upset the most careful calculations. It might be said that from the beginning the Missouri Botanical Garden has been sup-

ported on the "what-is-left" principle. In the old days it was "what-is-left" after the general and special taxes were paid. More recently it has been "what-is-left" after the taxes, cost of maintaining the estate, and the special bequests were provided for.

The gross income from all sources in 1937 was $225,000. Of this amount $60,000 went for taxes and cost of the estate, including insurance, repairs, annual bequests, Board of Trustees' office, etc. This left $165,000 available for all Garden expenses. Salaries and wages of all Garden employees, including those in the greenhouses or out of doors, in the heating plant, the scientific staff, the curator and librarian and attendants of the herbarium and library, the workers at the Arboretum, with those in the orchid houses and heating plant, and the Tropical Station on the Canal Zone, amounted to $132,000 or 80 per cent of the total. It is fair to add that it is the universal opinion of those familiar with the operation of similar institutions that the Garden is maintained with a remarkably small staff.

For fuel, water, repairs, and necessary supplies, there was expended in 1937, $25,000. The greenhouses are now twenty-five years old and need constant attention. There are thirteen other buildings which must be kept painted and repaired, besides trucks and farm and garden machinery which must be replaced. "What-is-left," amounting to $8,000, went for purchase of plants and seeds, books and herbarium specimens, supplies for students and staff, publication of the monthly BULLETIN and the quarterly ANNALS, office expenses, including electricity, telephone, postage, supplies, and innumerable items of less importance. It must be evident to anyone why those responsible for the administration of the affairs of the Garden have not been able, under existing conditions, to proceed with the development of the Arboretum at Gray Summit, or to undertake any major improvement. With the income for 1938 falling as it did to a new low and no assurance whatever that future years may not be worse, the outlook for the Missouri Botanical Garden even continuing on its present basis is not very encouraging. To those who appreciate the work the Garden has done and who are anxious to see it maintain its high place in the botanical and horticultural world, the opportunity of assisting in its development should appeal. Additional endow-

ment which will put the income back at least where it was in 1928, or specific gifts for special purposes are needed. Most of all, an endowment or outright bequest which will permit the Arboretum to be opened to the public is urgent.

OUTDOOR ACTIVITIES

During the summer months all trees in the developed sections of the Garden were pruned. A considerable portion of the month of August was devoted toward setting up an exhibition in the floral display house for the delegates attending the Fourteenth National Shade Tree Conference, meeting in St. Louis, August 30-September 2. The "wind machine" and a number of dendrographs were brought together so that the visitors might have an opportunity to observe some features of shade tree investigations as carried on at the Garden. The afternoon of September 1 was reserved as a "field day," and a demonstration of the latest in spraying equipment, fertilizing methods, and lightning protection for shade trees was held just south of the Iris Test Garden; while demonstrators of tree-moving equipment moved four oak trees from the North American tract and planted them near the old residence.

Approximately 1,000 trees and shrubs were brought from Gray Summit nurseries and planted in the Garden. Some of this work was done in early spring and the rest during November. The spading and edging of shrubbery beds was completed by May 10, and the first cultivation of these areas was begun on June 21.

The mowing, raking, and hauling of hay required just a month —from July 16 to August 15. Much more time, however, was spent in mowing weeds from those sections not covered by the power lawn-mower. Irrigation of bent grass began July 2, somewhat later than usual, and a top-dressing was applied July 6. The seriously burned areas were plugged after October 20.

The customary plowing, discing, and cultivating were carried on in the nurseries. Twenty-seven tons of lime were applied to those areas having an acid reaction of Ph 6 or less. At the same time 152 loads of soil from a steep bank along the Alfred Avenue fence were hauled and spread over the lowered surface of the nursery. About thirty more loads were used to re-grade some

portions of the lawns. The grading of the steep bank along the fence will facilitate mowing in the future.

The leaf-mold, compost, and soil bins were filled once in the spring and again in November and December. This necessitates the hauling, shredding and re-hauling, as needed, of about 300 cubic yards of material. Instead of the former practice of hauling leaves to the composting piles, this fall the leaves were swept directly into the shrubbery beds and covered with sufficient shredded leaf-mold to prevent their blowing about. If sufficient leaf-mold can be produced for greenhouses and top-dressing purposes, this method would be recommended since a deep mulch of leaves would do much toward reducing drought injury and might materially lessen the need for irrigation.

The tractor and mower were sent to Gray Summit for a period of three weeks during the summer.

About 1600 gallons of dormant spray were applied to trees and shrubs during 1938. The sprayer was also used for insect control in the greenhouses.

Knolls and Linnean Garden.—The perennial borders in these two gardens were maintained as in former years. Several new varieties of hardy chrysanthemums were added in the Linnean Garden. Rains were frequent in the spring, but the summer and fall were so dry that much time was consumed in watering.

Rose Garden.—This was an exceptionally good rose season as compared to some of the previous years, and both bush and climbing roses were at their best. The Jackson & Perkins Co. added thirty-seven roses, representing eleven varieties, to their trial collection.

Italian and Economic Gardens, Iris and Peony Garden.—The plants in all of these gardens experienced a good season. Thirty-three new varieties of irises were purchased for the iris collection.

Nursery.—With the purchase last summer of a new motor cultivator, hoeing and weeding in the nursery were reduced to a minimum.

FLORAL DISPLAYS

The orchid show was held from January 29 to February 20. Then followed a display of primroses, and on March 10 cinerarias were added.

No azaleas were shown at the Garden during 1938, because the entire collection was held for the two gardens installed in the Arena for the St. Louis Flower Show, March 26–April 3. One exhibit, covering 3,200 square feet, was a large formal garden surrounded by an evergreen hedge. Two pairs of ornamental iron gates, at the west end of the garden, terminated parallel gravel walks which separated the eight beds of azaleas. Four old iron vases were mounted on the gate piers and two large vases, each containing a large Kurume azalea, were placed at the intersections of the cross walks. The second display, which covered 1,600 square feet, represented a southern garden. Together with evergreens, magnolias, and tree wisterias, the azaleas were grouped around a pool and garden shelter, and trees draped with Spanish moss completed the setting. The azaleas which have been used in flower shows since 1929 have grown quite large, and this year it was necessary to rebuild and enlarge the lath house in which they are grown during the summer.

Schizanthus, snapdragons, marguerites, annual chrysanthemums, pelargoniums, hydrangeas, and other annuals were used in the various spring displays.

About 225 pot plants and numerous cut irises were used in the decorations for the annual flower sermon at Christ Church Cathedral on May 1.

The spring show of the St. Louis Horticultural Society was held in the Floral Display House May 21 and 22, and its fall show on October 8 and 9.

The Veiled Prophet Queen's bouquet of orchids was displayed October 13.

The annual chrysanthemum show was held from November 6 to December 4. The weather was ideal during this period, and the show attracted many local and out-of-town visitors.

The chrysanthemums were followed by the poinsettia show, one of the largest displays of these plants in recent years.

PHOTOGRAPHY

Mention should be made in this report of the importance of photography in the records of the Garden. We are fortunate in having on file excellent negatives of the original garden and its

operations, from the early nineties to the present time. To accompany garden lectures many hand-colored slides were made. The need for illustrations was apparent when the amateur gardening courses were started in 1929, and as a result hundreds of colored slides of annuals, bulbs, insects, irises, lawns, peonies, perennials, shrubs, trees, water gardens, and other subjects were gradually accumulated.

The Garden has kept pace with the developments in natural-color photography. In the lantern-slide collection are some well-preserved color plates made when the Lumiere process was introduced many years ago. When colored motion-picture film became available in 1935, several reels of garden views were assembled, and since February, 1937, miniature colored lantern slides have been made. Since color film is now obtainable in larger sizes it will be possible to maintain and supplement the present collections of standard slides which, for lack of material, cannot be duplicated.

MAIN CONSERVATORIES AND EXOTIC RANGES

With the exception of the succulents, no notable additions have been made to the exotic collections in these houses.

The old retaining walls in the Palm House were torn down and completely rebuilt in order to provide much-needed space in front of the steam pipes. This work necessitated a remodeling of the various plantings affected. As in other years, the palmetto and date palms produced abundant seed, but the squirrels, which have recently adopted the Palm House as their abode, stripped the fruit as soon as ripe. Consequently palm seedlings no longer cover the ground in dense masses.

The smoky atmosphere during the winter months makes it increasingly difficult to grow the exotic ferns which formerly were such a feature in the Cycad-Fern House. In spite of this handicap, the cycads, together with such showy ferns as *Cyrtomium falcatum* and the many varieties of *Nephrolepis exaltata,* present a satisfactory tropical aspect.

In the Economic House the exotics are grouped according to their use, rather than for effect. Supplemented by the summer garden of economic plants, these are of considerable educational value, particularly to the supervised groups of school children.

The large collection of aroids and bromeliads includes many rare specimens, and it is rapidly becoming one of the best of its kind in the world. Plants belonging to these groups require most careful attention, being easily lost under ordinary greenhouse conditions.

During the year a special guide to the succulents was published (May and June BULLETIN), the first time that a complete list of these plants has been made available. Several hundred new plants have been established in permanent beds, and more species are now on exhibition than at any previous time in the history of the Garden. The year has also been notable for the large number of succulents flowering, the cacti alone having borne over twelve hundred blossoms during the season.

EXPERIMENTAL GREENHOUSES

In addition to the routine planting of some 1,600 packets of seed and the making of thousands of cuttings of woody material, the growing of orchid seedlings on both symbiotic and asymbiotic media has been resumed. The opportunity of profiting by the experience of the past as to desirable crosses could not be resisted.

Attempts to breed improved strains of geraniums for bedding purposes have been continued, about 2,000 seedlings now being grown. Numerous crosses have also been made between commercial and wild forms of penstemons.

The endurance test on a large assortment of garden labels is still in progress (November, 1938, BULLETIN), and the hardiness of the gladiolus in this region continues to be demonstrated (December, 1937, BULLETIN). Corms left in the ground for three consecutive years were found to be in perfect condition. One clump, developed from a single corm planted in 1935, produced over forty fair-sized corms.

The experimental greenhouses are now well adapted for the work in amateur gardening. In the advanced course about 5,000 seedlings of various annuals and perennials are grown, and the same number of cuttings from fifty or more different plants are raised.

An important development has been a new nursery for material raised in the greenhouse or cold-frames. Located on fertile soil,

near the lake in the southwest part of the Garden, it is possible to irrigate this land at all times at small expense. The large number of magnolia seedlings, donated by Mr. Keller, are now established here.

CONSTRUCTION AND REPAIRS

The major items of repair have been concerned with the heating plant. During the summer 180 feet of 6-inch steam supply pipe and the same length of 3½-inch return pipe were laid from the valve-chamber to the administration building, a concrete trench being built for the purpose. Pipe coils, with supply line, were installed in the newly constructed greenhouse north of the Linnean Garden wall. The circulating drum in No. 1 boiler, being in bad condition, was replaced with a new one, and 16 new downdraft tubes connected to this drum. A regulator was provided in the heating-tunnel to supply the main leading to the Linnean House. The brick chimney at the heating plant has shown signs of needing repairs for some time, and when a favorable opportunity was presented the water table surmounting the corbelled head was renewed, the steel tension band cleaned and tightened, and the brick in the upper ten feet of the chimney cleaned and reset. The usual overhauling of the plant, including replacing grate bars, repairs to pumps, piping, thermostats, etc., was attended to.

The old lean-to greenhouse south of the Linnean Garden wall which was originally built from material salvaged from other houses, having outlived its usefulness, was wrecked during the year. A new house of the same general size and type has been built to accommodate a variety of plants which must be stored during the winter. Owing to the advanced age of some of the buildings, an unusual amount of painting and general repair work has been unavoidable during the year.

THE ARBORETUM

A special grant from the Garden Club of St. Louis made it possible to accomplish much more in the natural wild flower garden than could otherwise have been done. The chief work of the summer consisted in clearing the brush from several small meadows to prevent the extermination of meadow wild flowers by the invasion of the surrounding woodlands; controlling erosion and building up humus in the second-growth woodlands by felling dead trees

along the contour lines; and finally, the introduction from near-by localities of native species which are absent from the natural gardens. The last was done experimentally, on a very small scale, as a preliminary step in making larger plantings at a later date. Working with these wild gardens has afforded Dr. Anderson an opportunity to solve certain problems pertaining to the practical management of such tracts, the answers to which will be published shortly in the BULLETIN.

The collection of Oriental flowering crab-apples was checked over during the spring and summer in order that the trees comprising this outstanding feature of the Arboretum might be named as accurately as possible. A similar survey has been begun in the Pinetum. The daffodil plantation, which is gradually becoming more and more worth while is beginning to receive special attention. The double-flowering and bicolor varieties have been removed from the mass planting and set out as separate groups. A number of new and noteworthy varieties were obtained through purchase and exchange.

Nurseries and Plantations.—In order to save time and labor, the two nurseries which have been maintained for years at widely separated localities have been abandoned. A tract of land has been in preparation for a new nursery for a year, and this fall some 6,000 evergreens and about 8,500 deciduous trees and shrubs were moved from the old nurseries to the new location. In addition 3,000 deciduous trees and shrubs and over 1,000 evergreens from the nurseries were set out in permanent locations in various parts of the grounds. Approximately 10,000 additional daffodil bulbs were planted in the vicinity of the Pinetum. The usual number of hard-wood cuttings, seed plantings, and special propagations were made.

Miscellaneous.—General items of maintenance and repair account for much of the labor and expense involved in the upkeep of the grounds. Roads, trails, cutting of some 200 acres of grass several times a year, hauling gravel and coal (nineteen cars unloaded at siding and delivered to storage at heating plant), plowing firelines, hauling plant material for use at flower shows and for setting out in town, construction of a new road on the south side of the river, not to mention painting and minor items, are all

of importance and must be attended to if the Arboretum is not to deteriorate.

Orchid Range.—As is well known, the world-famous collection of orchid plants is established in a special range of twelve greenhouses at the Arboretum. On March 30 a severe hailstorm broke about 3,000 lights of glass, none of the houses escaping. Fortunately the damage to the plants was slight, and by lowering all shades and firing both boilers heavily it was possible to maintain a sufficiently high temperature until reglazing could be completed. It having been demonstrated that the slat shades were not able to protect the glass from hailstones of unusual size, the roofs of all the growing-houses were covered with a light steel superstructure on which wire netting was stretched. Advantage was taken of the opportunity to make all necessary repairs and to paint all the woodwork of each house. The number of orchid flowers, either cut or displayed, exceeded that of any previous year by several thousand, the total number being 23,820 blossoms.

Sunshine Record.—As in the past the number of hours of sunshine out of the city, at the Arboretum, exceed that in town by a considerable amount. With this excess coming as it does at the time of the year when the plants need it most, a still additional advantage of growing the orchids away from the city air is manifest.

Month	*City Garden*	*Arboretum*
January	88	115
February	78½	106
March	141½	171½
April	207½	193
May	216½	223½
June	252	259
July	289½	296
August	290	299
September	231	236
October	274	278
November	150	193½
December	86	126
	2,304½	2,496½
		2,304½
Excess at Arboretum		192

SUPERVISED INSTRUCTION FOR SCHOOL CHILDREN

Under the guidance of Miss Clara M. Heising, Special Nature Study Teacher assigned to the Garden by the Board of Education, the work with St. Louis school children has been continued. More than 7,000 pupils from elementary and high-schools have had lessons on trees, flowers, and plants in general, also on birds, insects, and other creatures, when they could be observed to advantage in the Garden. Even the weather was discussed when unusual clouds or other interesting phenomena were seen.

All lessons were followed by thought-provoking questions to stimulate the pupil's interest and observation. Wherever possible the lesson was correlated with the work in social studies, and it frequently happened that natural objects in the Garden provided subjects for art studies and motivation for compositions, letter-writing, public speaking, etc. Teachers accompanying classes were provided with lists of guiding-questions to further arouse the pupil's curiosity about living things in the home and school environment.

From lessons on plant life, classes gained a knowledge of conditions necessary to the growth of certain crops; the recognition of some of our common flowers; the response of plants to proper care; the appreciation of an attractive garden; the beauty and usefulness of trees; as well as many other simple truths not usually recognized.

A few of the birds observed, frequently including their feeding and other interesting habits, were the yellow warbler, brown creeper, little green heron, mourning dove, purple martin, flickers, redwings, osprey, crows, blackbirds, kingfisher, mocking-bird, coot, starling, and of course robins and sparrows. From such observations, with the accompanying talks, pupils learn the value of birds as destroyers of harmful insects, the dangers besetting them and how they can be protected.

Exercises on beneficial and injurious insects, including parasites, are given whenever suitable material is discovered. Such things as scale insects and lady-bugs are discussed, and lace-wing eggs, the "jugs" of the potter wasp, etc., are pointed out followed by guiding questions. Thus the pupils' interest is aroused and lessons are drawn from the part insects play in pollination, the good

as well as bad they do, Nature's control of pests, and similar every-day but little-known facts.

During the spring months, from 8:00 to 8:30 A. M., children attending school in the neighborhood were conducted on bird walks in the Garden. More than 1,000 attended at various times, mostly boys. Enthusiasm became so great that a Junior Audubon Club was organized. Thus in this and other phases of nature study, so easily accessible at the Garden, children are unconsciously developing their powers of observation and sense of hearing, their ability to report accurately what they see and hear, and a most worth-while way to use their leisure.

TROPICAL STATION, BALBOA, C. Z.

During the period of repairs to the Station residence, following the disastrous fire of September 1, 1937, Mr. Allen, the Manager, spent a month collecting living orchid plants and herbarium specimens in the Republic of Costa Rica. Some 750 sheets of herbarium material were secured, principally from the volcanos Poas and Irazu which were traversed to the summit, as well as from the region of Los Cerros de la Carpintera. Among the orchids the most interesting were 300 plants of *Cattleya Skinneri,* which do so well at the Station. During the month of February, the Director and Mrs. Moore paid a short visit to the Station.

In order to provide dry footing for visitors the concrete walk was continued from the water-lily pool to the orchid racks. This, with the steps and stone paving installed across the bridge leading past the fernery, greatly improved the appearance of that area.

During the year exchanges of orchid plants were continued with collectors in many countries. Nearly a hundred species new to the Station were received and are being tested to determine their adaptability to the climatic conditions. A large shipment of *Cattleya speciosissima* from Venezuela was held for a period of quarantine and reshipped to St. Louis.

The last remaining wooden orchid racks were wrecked and a house built in which to display blooming plants. This follows the general plan of a native Central American home, with a tile-roofed porch and solid concrete front. The rear portion is a green-

house, with glass roof and bronze screened sides. Water tanks are built under all the benches, which provide space for 400 pots.

A rip-rap wall of stone was built from the bridge to beyond the plant-house to allow the land in that area to be filled to level grade and plugged with Java grass. A 75-foot retaining wall was built on each side of the drain, making it possible to eliminate the last of the trash piles. During the year fifteen tree-ferns have been established in various conspicuous places about the grounds. These range in height from three to twenty feet, a grand specimen being placed near the corner of the water-lily pool.

Since the establishment of the first Sobralia orchid hedge (December BULLETIN) eighty additional feet have been planted, chiefly of the large-flowered *Sobralia leucoxantha*. Over 1,500 flowers were shown at a single time, filling the grounds with a delightful fragrance. In March and October respectively, blooming plants of *Cattleya Skinneri* and *Cattleya Deckeri* filled a flight of steps eight feet wide and forty feet long, and provided a colorful show for visitors.

Dr. Robert E. Woodson, Jr., and Mr. Russell J. Seibert visited the Station during July and August, using it as a base for drying and preparing the plants collected in the Republic of Panama. About 7,000 specimens were secured, principally from the region of the Volcano of Chiriquí, on the Costa Rican border.

Numerous trips have been made into the interior of Panama for orchids for the Station and for exchange, as well as for herbarium specimens. Some 3,000 herbarium sheets were sent to St. Louis, including the giant species of Aristolochia, obtained from the province of Darien, on the Colombian border.

RESEARCH AND INSTRUCTION

Dr. J. M. Greenman, Curator of the Herbarium and Professor in the Henry Shaw School of Botany of Washington University, as in previous years, has devoted the major part of his time and energy to curatorial duties of the herbarium. In addition to these exacting duties, he has continued to direct the research work of graduate students in taxonomy; he has also given advanced courses in the comparative morphology and taxonomy of flowering plants, liverworts, mosses, and ferns, as scheduled in the catalogues of Washington University.

Dr. Greenman, moreover, has continued to carry forward research work on special taxonomic problems on which he has been engaged for several years. Foremost among them are: a continuation of his "Monograph of the North and Central American Species of the Genus Senecio" and "A Flora of the Southwest," in both of which substantial progress may be recorded.

Dr. C. W. Dodge, Mycologist to the Garden and Professor in the Henry Shaw School of Botany of Washington University, spent the early part of the year in completing the manuscript of the botany of the Second Byrd Antarctic Expedition, and seeing it through the press. Mr. Paul Siple, botanist of the Expedition, wrote the ecological and geological portion of the report. Mr. E. B. Bartram prepared that on the mosses. The lichens and lichen parasites were described with the assistance of Dr. Gladys E. Baker of Hunter College who contributed the drawings and prepared most of the microscopic slides.

Routine determinations of large series of lichens have been completed: from Quebec, collected by Father Ernst Lepage; from Mexico, collected by Professor Ruiz; Stictaceae of Chile, collected by the late Professor Thaxter; from Colombia, collected by Bro. Azael; and from Costa Rica and Panama, collected by Dr. Dodge and others. Mr. Timothy Murphy has assisted in the preparation of microscopic slides, and Mr. D. F. Flint has aided in clerical work and in the insertion of specimens in the lichen and fungus herbaria.

Under a grant from the International Cancer Research Foundation, the study of the action of methyl cholanthrene on *Saccharomyces ellipsoideus* has been continued. Mr. Stanley Hagen, A.M., Washington University, resigned the research assistantship on July 1.

The usual courses of instruction have been given and reseach students supervised. The doubling of the enrollment in bacteriology necessitated an extra laboratory section. Mr. G. T. Johnson and Mr. A. C. Jones completed their study of heterothallism and the physiology of a new species of *Coprinus*. Mr. Hagen studied the morphology of a new species of *Collema*. Mr. G. T. Johnson is continuing his study of the morphology and relationships of the pyrenocarp lichens, especially the Trypetheliaceae, for his doctorate.

Dr. Edgar Anderson, Geneticist to the Garden and Engelmann Professor in the Henry Shaw School of Botany of Washington University, has continued his teaching and administrative duties at the University. His research has been centered around the species problem, chiefly in the genera *Acer* and *Tradescantia*. With his technical assistant, Mr. Leslie Hubricht, he has published two papers during the year and others are in preparation. Mr. William L. Brown has continued his horticultural and botanical studies of the lawn-grass problem in St. Louis, with special emphasis upon the classification, culture, and improvement of Kentucky blue grass, *Poa pratensis*.

Dr. E. S. Reynolds, Physiologist to the Garden and Associate Professor in the Henry Shaw School of Botany of Washington University, has given special emphasis to laboratory studies on the positive action of the root system upon the process of transpiration. This problem is closely associated with that of the action of the liquid and gaseous contents of the vascular system in relation to the rise of sap, and with that of the action of hormones upon root growth and activity. Progress has been made in the study of these last two problems during the past two or more years, but dependable conclusions can be obtained only by proper correlation of the various factors involved after an experimental period of several years' duration. It has not been thought desirable to follow the common practice of publishing partial and preliminary reports upon investigations in progress, but to reserve the material for more conclusive contributions. In accord with this principle a careful analysis of the four years' records of tree temperature studies, referred to in former reports, has been made. This has consumed much time, but it is believed that the results and conclusions will justify the procedure. An extensive paper embodying this work has been prepared and will shortly be ready for publication. The usual courses and seminar in plant physiology and supervision of the investigational work of graduate students have been continued.

Dr. Robert E. Woodson, Jr., Assistant Curator of the Herbarium and Assistant Professor in the Henry Shaw School of Botany of Washington University, remains in charge of classes at the University in general plant biology, elementary morphology

and taxonomy, and anatomy of vascular plants. In the fall, increased interest in botany was evidenced by a registration in the first- and second-year courses somewhat more than double that of the previous year. As in former years, Dr. Woodson has continued taxonomic and morphological research in Apocynaceae, and a survey of the flowering plants of Panama.

During the months of June, July, and August, Dr. Woodson, assisted by Paul H. Allen, the Manager of the Tropical Station, and Russell J. Seibert, collected approximately 7,000 herbarium specimens in various localities in Panama under the joint auspices of the Missouri Botanical Garden and the Arnold Arboretum of Harvard University.

Graduates and Fellows.—The following appointments were made in the Henry Shaw School of Botany for the year 1938-39:

Assistants in Botany (part-time): Elizabeth Ammerman, A.B., Washington University (Taxonomy and Morphology); Henry N. Andrews, B.S., Massachusetts Institute of Technology, M.S., Washington University (Morphology and Taxonomy); Edward C. Berry, B.S., State Teachers College, Warrensburg, Mo., M.A., University of Missouri (Mycology); Jean Elder Martin, A.B., Washington University (Mycology); Ralph Edmund Rawlings, B.S., University of Arkansas (Mycology and Taxonomy).

Washington University Fellowship: George Thomas Johnson, A.B., University of Arkansas, M.S., Washington University (Mycology and Taxonomy).

Jessie R. Barr Fellowship: Mary Maxine Larisey, A.B. and M.S., Washington University (Taxonomy and Morphology).

Washington University Van Blarcom Scholarship: Hugh Carson Cutler, B.A. and M.A., University of Wisconsin (Taxonomy).

Washington University Scholarship: Francis Marion Ownbey, B.A. and M.A., University of Wyoming (Taxonomy).

Special Fellowship: William L. Brown, A.B., Bridgewater College, Bridgewater, Va. (Cytology and Taxonomy).

Independent Students: Gordon William Davis, A.B., Knox College, M.S., Washington University (Physiology); Elizabeth Jeanette Heuser, A.B., Washington University; Charlotte J. Manewal, B.A., Harris Teachers College, M.S., Washington University (Physiology).

Garden Apprentices: Robert Brown Clark, B.S., Massachusetts State College; Robert Schery, A.B., Washington University. Ralph Emons resigned in September to enter Washington University.

Degrees.—The following students in the Henry Shaw School of Botany received advanced degrees at the Washington University commencement in June: Mary Goddard, B.E., Illinois State Normal College, M.S., University of Michigan (Mycology and Taxonomy) and Hereford Garland, B.S. and M.S., University of California (Physiology, Taxonomy, and Anatomy)—Doctor of Philosophy; Gordon William Davis, A.B., Knox College, M.S., Washington University (Physiology), Stanley H. Hagen, B.S., University of Oklahoma (Taxonomy), George Thomas Johnson, B.A., University of Arkansas (Mycology and Taxonomy), Charlotte Josephine Manewal, B.A., Harris Teachers College, M.S., Washington University (Physiology and Education), and Russell J. Seibert, A.B., Washington University (Taxonomy and Morphology)—Master of Science.

Published Articles.—

Allen, Paul H.: A Hedge of Orchids. Mo. Bot. Gard. Bull. **26:** 188–192. December, 1938; Notes from the Missouri Botanical Garden Tropical Station, Balboa, Canal Zone. Mo. Bot. Gard. Bull. **26:** 78–82. April, 1938.

Anderson, Edgar: Mints and Microspores. The Herbarist, No. 4: 15–16. 1938; and Hubricht, Leslie: The American Sugar Maples. I. Phylogenetic Relationships as Deduced from a Study of Leaf Variation. Bot. Gaz: **100:** 312–323. December, 1938; and Hubricht, Leslie: Hybridization in Tradescantia. III. The Evidence for Introgressive Hybridization. Am. Jour. Bot. **25:** 396–402. June, 1938; and Turrill, W. B.: Statistical Studies on Two Populations of Fraxinus. New Phytologist **37:** 160–172. April, 1938.

Beilmann, A. P.: The Behavior of a Basswood during an Artificial Windstorm. Mo. Bot. Gard. Bull. **26:** 50–56. February, 1938; The Chinese Elm. Mo. Bot. Gard. Bull. **26:** 48–50. February, 1938; Common Native Trees of Missouri. III. Osage Orange (*Maclura pomifera* (Raf.) Schneider). Mo. Bot. Gard.

Bull. **26:** 75–78. April, 1938; The General Care of Shade Trees. Mo. Bot. Gard. Bull. **26:** 115–129. September, 1938.

Cutak, Ladislaus: *Aloe vera* as a Remedy for Burns. Cactus and Succulent Jour. Amer. **10:** 76–78. November, 1938 (Reprinted from Mo. Bot. Gard. Bull. **25:** 169–174. December, 1937); Guide to the Succulent Plant Collection of the Missouri Botanical Garden. Mo. Bot. Gard. Bull. **26:** 85–98, 99–112. May and June, 1938; Living Pebbles and Stones. Mo. Bot. Gard. Bull. **26:** 63–70. March, 1938; Report of a Plant Hunt in Texas. Mo. Bot. Gard. Bull. **26:** 180–187. December, 1938; Sansevierias as House Plants. Desert Plant Life **10:** 69–70, 77. April, 1938 (Reprinted from Mo. Bot. Gard. Bull. **25:** 95–103. June, 1937); Succulents at the Greater St. Louis Flower and Garden Show. Cactus and Succulent Jour. Amer. **10:** 27. August, 1938; Succulents at the Missouri Botanical Garden. Desert Plant Life **10:** 43–45, 50–51. March, 1938; Succulents in the Home. Desert Plant Life **10:** 212. October, 1938; Succulents Merit a Trial in the Home. Desert Plant Life **10:** 88–89. October, 1938.

Dodge, Carroll W. and Baker, Gladys E.: Botany of the Second Byrd Antarctic Expedition. II. Lichens and Lichen Parasites. Ann. Mo. Bot. Gard. **25:** 515–718. April, 1938.

Fairburn, David C.: The General Care of House Plants. Real Gardening, No. 8: 49–56. December, 1938; Labeling Plants Permanently. Mo. Bot. Gard. Bull. **26:** 153–156. November, 1938; Ridding the Garden of Moles. Mo. Bot. Gard. Bull. **26:** 146–147. October, 1938; Softening Bleak Exteriors. Modern Hospital Mag. **50:** 44–46. April, 1938; New Plants from Old. Real Gardening, No. 3: 44–50. No. 4: 45–53. No. 5: 51–58. July, August, and September, 1938; A New Use for Coat Hangers. Mo. Bot. Gard. Bull. **26:** 70–72. March, 1938.

Greenman, J. M.: The Genus Bidens. By Earl Edward Sherff. (Review). Bot. Gaz. **99:** 667. March, 1938; *Senecio schizotrichus, S. streptothamnus,* and *S. Tonduzii.* In Standley's Fl. Costa Rica. Field Mus. Nat. Hist. Bot. Ser. **18:** 1518–1519. November, 1938; Studies of South American Senecios—II. Ann. Mo. Bot. Gard. **25:** 795–822. November, 1938.

Jensen, L. P.: Report on Roadside Development. Flower Grower **25:** 233. May, 1938; Report on Wildlife Conservation in Missouri. Flower Grower **25:** 416–417. September, 1938; Trees

and Shrubs. Fruit- and Berry-bearing Trees and Shrubs for Landscape Effects and Forage for Birds. Garden Life **11:** 87–88. November, 1938.

Johnson, George Thomas: The Taxonomic Importance and Phylogenetic Significance of the Cephalodia of Stereocaulon. Ann. Mo. Bot. Gard. **25:** 729–768. September, 1938; and Schmitt, Francis O.: Optical and Chemical Studies on the Granules in Microspores of Tradescantia. Ann. Mo. Bot. Gard. **25:** 455–466. April, 1938.

Kohl, Paul A.: Cascade Chrysanthemums. Bull. Chrysanthemum Soc. Amer. **6,** No. 2: 3–5. 1938; What Is Involved in Setting Up a Chrysanthemum Show. Mo. Bot. Gard. Bull. **26:** 135–146. October, 1938; What Shall We Do with the Christmas Poinsettia? Mo. Bot. Gard. Bull. **26:** 175–180. December, 1938.

Larisey, Maxine: An Exotic Crotalaria at Home in St. Louis Gardens. Mo. Bot. Gard. Bull. **26:** 168–170. November, 1938.

Pring, George H.: Gardens Which Need No Cultivation. Horticulture **16:** 221. May 15, 1938; Wintering and Propagating Water-lilies. Horticulture **16:** 358–359. September 15, 1938.

Seibert, Russell J. (with Woodson, Robert E., Jr.): Contributions toward a Flora of Panama. II. Miscellaneous Collections during 1936–1938. Ann. Mo. Bot. Gard. **26:** 823–840. November, 1938.

Woodson, Robert E., Jr.: Apocynaceae. N. Amer. Flora **29,** pt. 2: 103–192. 1938; Studies in the Apocynaceae. VII. An Evaluation of the Genera Plumeria L. and Himatanthus Willd. Ann. Mo. Bot. Gard. **25:** 189–224. February, 1938; and Moore, John Adam: The Vascular Anatomy and Comparative Morphology of Apocynaceous Flowers. Bull. Torr. Bot. Club **65:** 135–166. March, 1938; and Seibert, Russell J. Contributions toward a Flora of Panama. II. Miscellaneous Collections during 1936–38. Ann. Mo. Bot. Gard. **25:** 823–840. November, 1938.

Scientific and Popular Lectures.—

Dr. Edgar Anderson, Geneticist to the Garden: March 30, over Radio Station KSD, "How Forsythia First Came to this Country"; May 19, St. Louis Garden Club, "Understanding Wild Flowers"; December 2, St. Louis Horticultural Society, "American Gardens and the American Climate."

Mr. A. P. Beilmann, Arboriculturist to the Garden: January 10, Men's Garden Club, Des Moines, Iowa, "The General Care of Trees"; January 12, Illinois State Nurserymen's Association, Chicago, Illinois, "The Feeding of Shade Trees"; January 28, annual meeting of the Webster Groves Garden Clubs, "Trees"; March 2, Cooperative Club, and March 4, St. Louis Horticultural Society, "Trees."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden: March 23, Botany 101 class of Washington University, "Exploring Southwestern Deserts for Cacti"; April 26, senior group of Holy Name Society of St. Margaret's Church, and June 1, Young Peoples' Club of Our Lady of Lourdes Church, University City, "Vagabonding in the Southwest"; November 14, Washington University Society of Asklepios, "Searching for Botanical Treasures in Texan Deserts"; November 16, St. Louis Camera Club, Exploring Texas with Camera and Tripod."

Dr. Carroll W. Dodge, Mycologist to the Garden: April 12, Eastern Missouri section of Society of American Bacteriologists, "Some Effects of Carcinogenic Substances on Yeasts."

Dr. David C. Fairburn, Horticulturist to the Garden: February 16, Boy Scouts of Grace Methodist Church, "Insects"; November 1, group of amateur gardeners at the Walbridge School, "House Plants"; November 2, elementary botany class of Washington University, "Forcing Hardy Bulbs."

Mr. L. P. Jensen, Manager of the Garden Arboretum: February 17, Eighth District of the Missouri State Federation of Women's Clubs, at the Hotel Chase, "Roadside Improvement and Its Relation to Conservation"; March 3, School Board Association of Franklin County, at the High School Auditorium, Union, Mo., "Planting of School Grounds"; March 21, Manchester School Association, Manchester, Mo., "The Relation of Gardening to Community Life"; April 20, at Hermann, Mo., "The Value of a Garden Club to the Community"; May 5, Lansdowne Garden Club of East St. Louis, "Conservation of Native Plants"; May 28, St. Louis Naturalists' Club, "Roadside Development"; July 31, at opening of a nature trail, Meramec State Forest, Sullivan, Mo., "The Romance of Botany"; September 19, convention of the American Institute of Park Executives, "Fruit- and Berry-

bearing Trees and Shrubs for Landscape Effects and Bird Forage"; October 2, Gray Summit Garden Club, "Ornamental Fruit- and Berry-bearing Trees and Shrubs"; November 1, State Federation of Garden Clubs, Cuba, Mo., "Conservation and Planting Along the Roadsides"; November 14, Wayside Garden Club of Manchester, Mo., "The Country Roadside Improved"; November 19, Greater St. Louis Association of Gardeners, Maplewood, Mo., "The Joy of Gardening."

Mr. Paul A. Kohl, Floriculturist to the Garden: January 11, St. Louis Hills Garden Club, "If I Were to Make a Garden"; April 25, Business and Professional Women's Group of the Church of St. Michael and St. George, "A Year in the Garden"; April 29, Junior Gardeners of the St. Louis Garden Club, "Gardening"; May 19, Winstanley Garden Club of East St. Louis, "Roses"; October 1, Normandy Circle of the Rose-Mary Garden Club, "Roses."

Dr. George T. Moore, Director of the Garden: January 28, Union Avenue Christian Church, "The Garden and Its Founder"; March 23, over Radio Station KMOX, "The Value of the Flower Show"; May 2, St. Louis section of the American Chemical Society, at the DeSoto Hotel, "Plants and People."

Mr. George H. Pring, Superintendent of the Garden: at Columbus, Ohio, Ohio State University, January 10, "Orchid Culture," January 11, "Taxonomy of Orchids," and January 12, Columbus Landscape Association, "New Introductions Growing at the Arboretum at Gray Summit"; at Boston, afternoon of February 9, Massachusetts Horticultural Society, "The Breeding and Growing of Water-lilies," evening of February 9, The Boston Horticultural Club, "Gardening in the West"; February 20, over Radio Station WEW, "The Orchid Show"; February 23, Quest Club, at the Kingshighway Presbyterian Church, "The History of Shaw's Garden"; March 10, St. Louis Florists' Club, "The Missouri Botanical Garden, Past and Present"; March 15, Patrons' Association of the Sigel School, "Plant Collecting in Panama and South America"; April 12, Quincy Garden Club, Quincy, Ill., "Designing and Planting Gardens"; April 27, elementary botany class of Washington University, "The Missouri Botanical Garden, Past and Present"; July 14, St. Louis Florists' Club, "Commercial

Flower Growing in England"; August 5, St. Louis Horticultural Society, "English Gardens"; August 12, South Side Kiwanis Club, "Originating New Flowers at the Garden"; October 24, Cape Girardeau Garden Club, Cape Girardeau, Mo., "Chrysanthemums"; November 1, Rotary Club of Belleville, Ill., "The Romance of the Plant World"; November 17, Rose-Mary Garden Club, "Plants of Economic Value."

Dr. Hermann von Schrenk, Pathologist to the Garden: January 18, Western Society of Engineers, at Chicago, Ill., "Termites"; March 25, over Radio Station KMOX, "Gardens for Private Estates"; November 14, Canadian Railway Club, at Montreal, Canada, "Timbers as Used by Railroads."

Dr. Robert E. Woodson, Jr., Assistant Curator of the Herbarium: February 23, Academy of Science of St. Louis, "Behind the Scenes of a Flora of Panama."

HERBARIUM

The numerous lines of activity in the herbarium have continued intensively during the past year. A relatively large number of specimens has been acquired from many and remote parts of the world. The most extensive additions, however, have been from the interior and western parts of the United States, Mexico, Central and South America. It seems desirable, as in previous years, to assemble at this time the larger and more important acquisitions to the general collection.

New Accessions.—Paul Allen, 450 plants of Panama; E. Anderson, 55 plants from the central United States and of horticulture; Arnold Arboretum, 775 plants mostly from the western part of the United States; Fred A. Barkley, 594 plants of Montana; Alan A. Beetle, 140 plants of Colorado; Botanical Garden, Bacou, URSS., 206 plants of Transcaucasia; Botanical Garden, Berlin-Dahlem, 43 plants of Ecuador; Botanical Museum of Harvard University, 276 plants, mostly orchids, of Mexico; Albert Chandler, 104 plants of New Hampshire and Missouri; Ira W. Clokey, 3214 plants of Nevada and California; Mrs. W. B. Collom, 195 plants of Arizona; Henry S. Conard, 100 mosses of Iowa; Cornell University, 140 plants of Whatcom County, Washington; Hugh C. Cutler, 251 plants of southwestern United States; Mrs. S. B.

Davidson, 368 plants of Panama; Otto Degener, 98 plants of the Hawaiian Islands; Delzie Demaree, 952 plants chiefly from Arkansas; Desert Laboratory, Tucson, 230 plants of Sonora and Arizona; C. W. Dodge, 56 plants of Central America; J. A. Drushel, 100 plants of New Jersey and other eastern states; C. F. E. Erichsen, 100 lichens of Germany; Joseph Ewan, 61 plants of the San Gabriel Mountains, California; Walter J. Eyerdam, 906 plants of Washington and Alaska; Field Museum of Natural History, 113 plants of Missouri and 37 photographs of type specimens; George L. Fisher, 126 plants of Mexico; Florida Agricultural Experiment Station, 237 plants of Florida and North Carolina; David C. Fairburn and Ben Lowenhaupt, 134 plants of horticulture; Fort Hays Kansas State College, 202 plants of Kansas; Howard Scott Gentry, 120 plants of Sonora and Lower California; T. H. Goodspeed, 358 plants of Andean South America; Adele Lewis Grant, 485 plants of South Africa; Gray Herbarium of Harvard University, 92 plants of Virginia and 147 plants mostly from Nevada and Cuba; J. M. Greenman, 107 plants of Missouri and 30 photographs of South American Senecios; George B. Happ, 285 plants of Mexico; F. J. Hermann, 211 plants of Michigan, Illinois, and Wisconsin; George B. Hinton, 507 plants of Mexico; Leslie Hubricht, 757 plants of the central and southwestern states; Instituto Miguel Lillo, 64 plants of northern Argentina; L. A. Kenoyer, 581 plants of Mexico; Lingnan University, 350 plants of China; Maude C. Lodewyks, 144 plants of Wisconsin, Illinois, and Missouri; Mrs. Henry B. Looff, 200 plants of Alaska; A. H. Magnusen, 150 plants of Sweden; Marshall College, 100 plants of West Virginia; Montana State University, 109 plants of Montana; A. Nelson, 410 plants of Arizona; New York Botanical Garden, 47 plants of South America; Philadelphia Academy of Natural Sciences, 300 plants of the eastern United States; Marion Ownbey, 2250 plants of western United States; Pomona College, 323 plants of western United States; Rancho Santa Ana Botanic Garden, 98 plants of California; Reed C. Rollins, 465 plants of Wyoming, Colorado, and Utah; Royal Horticultural Society's Gardens, 100 plants of England, China, and of horticulture; Alexander F. Skutch, 336 plants of Costa Rica; Paul C. Standley, 400 plants of Costa Rica; Julian A. Steyermark, 4404 plants of Missouri; Hermann Schwarz, 143

plants of Colorado and New Mexico; United States National Museum, 205 plants of Virginia, Venezuela, etc.; University of Arizona, 119 plants of Arizona; University of Brno, 200 plants of Czechoslovakia; University of California, Berkeley, 297 plants of California and Mexico; University of California at Los Angeles, 413 plants of California, Arizona, and Nicaragua; University of Cluj, 220 plants of Roumania; University of Colorado, 72 plants of Colorado; University of Iowa, 56 plants of Iowa; University of Michigan, 1020 plants of Mexico and Central America; University of Pennsylvania, 50 plants of southern New Jersey; University of Washington, 82 plants of Washington and Alaska; Fr. Verdoorn, 100 mosses and 50 hepatics from various countries; H. von Schrenk, 80 plants of Missouri and Guatemala; Th. Oswald Weigel, 25 fungi from Germany; F. Lyle Wynd, 107 plants of Mexico.

Numerous smaller accessions have been received and recorded in current numbers of the Garden BULLETIN.

Mounting and Insertion of Specimens.—The mounting and insertion of new material have continued throughout the year. Mr. Alexander Gordon was employed by the Garden during the summer months, as an extra mounter; and a limited amount of assistance has been had from undergraduate NYA students of Washington University. Even with this additional service, it has been impossible to keep apace with the current accessions of new material.

Exchanges.—During the year there were received from scientific institutions and individual botanists with whom the Garden maintains exchanges approximately 12,000 specimens. In the same period nearly 1,500 duplicate herbarium specimens have been distributed to American and foreign correspondents. It should be stated, however, that a considerable number of the plants received in this manner have been acquired in exchange for duplicate botanical literature and regular publications of the Garden. More than 3,000 duplicate herbarium specimens are now ready for distribution, but on account of the temporary congestion in express and mail service they are being withheld until after the holiday season.

Field Work.—During the months of June, July, and August, the Garden sponsored a collecting expedition to Panama by R. E. Woodson, Jr., P. H. Allen, and R. J. Seibert, in collaboration with the Arnold Arboretum of Harvard University, during which in excess of 1,200 numbers of vascular plants were obtained. Work on a projected "Flora of Panama" has continued with the assistance of numerous specialists. More extensive field work has been carried on this year by members of the staff and by graduate students than for a number of years past. A relatively large amount of material has been obtained in this way, which, when sorted, arranged, and named, will constitute an important addition to the permanent collections of the herbarium; and the duplicates will make valuable material for exchanges. Past and present graduate students continue to contribute collections from near and remote regions. The herbarium is greatly enhanced by these valued contributions.

Use of the Herbarium.—It is a satisfaction again to record that the herbarium is performing an increasing service to those interested in plants as well as to the professional taxonomist. During the past year the number of botanists visiting the herbarium for critical taxonomic work is considerably larger than in previous years. The requests for loans of specimens to research workers and to specialists for monographic study have greatly increased. The temporary withdrawal of specimens for this purpose and the necessary records pertinent thereto require considerable salaried time. Thus far no charge has been made for time devoted to this work, regardless of the size of the loan. It has been considered that the enhanced scientific value of the material thus critically studied is ample recompense.

Groups of Plants under Special Study.—Several groups of plants have received particular attention during the year. Among these the following may be mentioned: Lichens by C. W. Dodge, Edward C. Berry, and D. Flint; Hepaticae by George T. Johnson; *Ephedra* by Hugh C. Cutler; Gramineae, especially the genus *Poa,* by William L. Brown; *Tradescantia* by E. Anderson; *Polygonatum* by Ruth Peck Ownbey; *Calochortus* by Marion Ownbey; *Baptisia* and *Thermopsis* by Maxine Larisey; Bignoniaceae, par-

ticularly the genus *Tabebuia,* by Russell J. Seibert; *Palafoxia* and *Polypteris* by Elizabeth Ammerman; and the Compositae, especially the South American Senecios, by J. M. Greenman. Dr. R. E. Woodson, Jr., Assistant Curator of the Herbarium, has continued his studies of Apocynaceae, and is also undertaking a monographic treatment of the New World species of the genus *Asclepias.* In some of these groups an intensive field study, as well as an herbarium study, has been made; but in all the groups concerned many new and valuable specimens have been acquired. Furthermore, in all cases the herbarium material has been reorganized in the light of critical study and recent literature:

Statistical Summary (for the year ending December 31, 1938):

By purchase	10,891	
By gift	2,646	
By exchange	11,308	
By transfer	215	
By field work	3,061	
Total	28,121	
Number of specimens mounted and incorporated in 1938		20,819
Number of specimens received in 1938, still unmounted		7,302
Number of specimens in herbarium, carried forward from 1937		1,254,641
Total		1,282,762
Number of specimens discarded in 1938	42	
Number of duplicates withdrawn in 1938	88	
	130	
Total number of specimens in herbarium		1,282,632

A Review.—The present year marks the close of a quarter-century period of the herbarium under the curatorship of the present curator, Dr. J. M. Greenman. During this time the number of specimens in the herbarium has more than doubled. While particular attention has been centered on the flora of the southwestern United States, yet the greater objective—to build up a well-proportioned herbarium representative of the world's flora, so that comparative studies and monographic work could be pursued with satisfaction—has been kept constantly in the foreground. To this end it was deemed essential to augment the representation of the flora of western United States and Canada, Mexico, the

West Indies, Central and South America. Hence, relatively large collections have been obtained from nearly all parts of the western hemisphere, except the vast expanse of arctic and subarctic North America and the interior of South America, which regions for the most part remain yet to be botanically explored. At the same time, however, many and important collections have been added to our representation of the Old World flora, particularly from Europe, the Philippine Islands, Asia, and South Africa.

It is worthy of note also, that during this time all the old wooden herbarium cases have been replaced by fire-proof and dust-proof uniform steel cases; and the specimens have been rearranged and reorganized to accord with a unified system of classification. All this work and the many details incidental thereto, which are too numerous and varied to be mentioned at this time, have been accomplished by a comparatively small herbarium staff.

The twenty-third ANNUAL REPORT of the Missouri Botanical Garden (1912) states that the herbarium then contained 698,706 specimens. Careful computation, aided by the stamping and numbering of all specimens mounted since 1912, shows that the herbarium now contains 1,282,632 specimens. This number, however, includes 133,713 specimens, which are unmounted and not readily available for study.

The imperative needs of the herbarium, therefore, at the present time are: *first*, additional steel cases to permit of further expansion and to adequately protect the specimens from damage by overcrowding and the loss by fire; and *second*, more help in mounting the unmounted specimens in order to render them available for study.

LIBRARY AND PUBLICATIONS

Each year, for many years, the congestion of the books in the Garden library has been featured in the annual reports. It had come to the point that growth was not looked upon as progress but as a problem in shelving. The first-floor cases, which constitute nearly half the library, were not only filled but books were lying upon top of each other and some were on the window sills. The only unoccupied space was in the old lecture room (sections D-F), and in order to take advantage of that space those sections

would have to be closed up and every book in sections A-D moved back. This work was begun in 1936 as a "pick-up" job when no other work was pressing. Naturally, the progress was slow, and the crowded condition in certain sections was becoming greater. During the summer of 1938 the library staff, by putting other work aside and concentrating on shifting and cleaning the books, completed the task before September. Unfortunately there was not time to do as much cleaning, relabeling, and recataloguing as was desirable, and these operations will have to wait until next summer. Even with this shifting, the library can accommodate only about five years' growth. Weeding-out unbotanical literature might provide for another year, but in the meanwhile the books in the basement are becoming over-crowded and will have to be taken care of soon.

Much of the time of the library staff has been spent in checking the Garden publications for various bibliographical lists, such as the subject index to the Union List of Serials and the new supplement to the Union List. Not only is this of value in bibliography but it also makes us aware of our lacunae and helps us to correct occasional mistakes in cataloguing.

New Accessions.—No especial collections were purchased during the year, and a rather rigid system of economy has been practiced in ordering. Several publications have been removed from the subscription list, either because the work could be found elsewhere in St. Louis or because it was expensive and not used frequently enough to warrant the cost. An accession worthy of special mention was Jacquin's "Fragmenta Botanica, figuris coloratis illustrata," 1800-1809. The acquisition of this book gives the library an almost complete file of Jacquin's important works. According to one authority, the "Fragmenta" contains perhaps the most beautiful of all Jacquin's plates. The book is very rare and while it had been listed in catalogues in recent years the price had always been prohibitive. Catalogues lately have seemed to feature European floras, and the Garden has been fortunate in obtaining many of these to supplement its collection. Among other important works received were Robyns' "Flore Agrostologique du Congo Belge," pts. I & II; a manuscript copy of "Bibliography of the applications of electro-optic techniques applied to biological prob-

lems," prepared under the auspices of the Rockefeller Foundation, by Dr. R. A. Hollaender; all the lacking volumes of "Videnskabelige Medelelser fra Dansk Naturhistorisk Forening i Kjobenhavn"; and a photostatic copy of Ecklon and Zeyher's "Enumeratio plantarum Africae . . ." part 1, the library already having parts 2 and 3.

Garden Publications.—Volume XXV of the quarterly ANNALS OF THE MISSOURI BOTANICAL GARDEN was issued during the year, the volume containing 853 pages and 69 plates. The February number (No. 1) consists of papers by seven of Dr. Greenman's former students and was completed in time for a copy to be presented to Dr. Greenman on his birthday, December 27, 1937. The second number comprises the botany of the Second Byrd Antarctic Expedition, and in addition to a paper on the lichens by Dr. Dodge and Dr. Baker, contains a paper on the geology of the region by Mr. Paul A. Siple, Biologist of the Expedition, and one on mosses by Mr. Edwin B. Bartram.

The 1938 volume of the BULLETIN (Vol. XXVI), which is issued monthly except July and August, contains 204 pages and 30 plates. Some of the outstanding BULLETINS were: "The Guide to the Cactus and Succulent Collection" by Ladislaus Cutak, issued as the May and June numbers, later bound together and sold for twenty-five cents; and Beilmann's "Care and Feeding of Shade Trees," the September number, which was published in August in order that it might be available for the National Shade Tree Conference meeting in St. Louis, August 30-September 2.

There are now 253 persons and institutions subscribing to the BULLETIN and 129 sending publications in exchange. There are 79 subscriptions to the ANNALS and 426 foreign and 126 domestic exchanges. On account of the expense of mailing, the usual practice of sending ANNALS reprints to other botanists in exchange for their publications was discontinued in 1938. The cash receipts during the year from all Garden publications was $2,144.97.

Use of the Library.—In addition to the staff and students in the Henry Shaw School of Botany, the following out-of-town botanists have consulted the library during the year: Dr. Esther Adams, Teacher of Biological Sciences, Moberly Junior College,

Moberly, Mo.; Mr. Eugene Adams, graduate student in botany, University of Georgia, Athens; Mr. Oakes Ames, Professor of Botany, Harvard University; Dr. Gladys E. Baker, Instructor in Botany, Hunter College, New York City; Mr. Milford Benham, Teacher of Science, De Kalb Township High School, De Kalb, Ill.; Mr. E. G. Beinhart, A.A.A., Dept. Agr., Washington, D.C.; Miss Helen Bramsch, graduate student in botany, University of California, Berkeley; Mr. Norman Butterfield, graduate student in botany, Purdue University, Lafayette, Ind.; Dr. W. H. Camp, Assistant Curator, New York Botanical Garden, New York City; Dr. Hamilton H. Card, pelargonium specialist, La Mesa, Calif.; Dr. H. S. Conard, Head Department of Botany, Grinnell College, Grinnell, Iowa; Miss Phyllis Cook, graduate student in botany, University of Illinois, Urbana; Miss Grace Denny, Teacher of Biology, East Texas College, Commerce; Mr. A. F. Dodge, of the Soil Conservation Service, U. S. Dept. Agr., Ames, Iowa; Dr. Theodosius Dobzhansky, Professor of Genetics, California Institute of Technology, Pasadena; Dr. W. B. Drew, Assistant Professor of Botany, University of Missouri, Columbia; Dr. Francis Drouet, Curator of Cryptogamic Botany, Field Museum of Natural History, Chicago; Mr. E. T. Edwards, Plant Pathologist, Dept. Agr., New South Wales, Australia; Mr. Thomas H. Everett, Horticulturist, New York Botanical Garden, New York City; Dr. Norman Fassett, Assistant Professor of Botany, University of Wisconsin, Madison; Mr. Paul T. Frese, Associate Editor *Better Homes and Gardens;* Dr. Harry J. Fuller, Assistant Professor of Botany, University of Illinois, Urbana; Dr. George J. Goodman, Assistant Professor of Botany, Iowa State College, Ames; Dr. George B. Happ, Assistant Professor of Biology, Principia College, Elsah, Ill.; Dr. Charles J. Harrison, graduate student in botany, University of Washington, Seattle; Miss Lena B. Henderson, Associate Professor of Botany, Randolph-Macon College, Lynchburg, Va.; Mr. Alfred C. Hottes, Associate Editor *Better Homes and Gardens;* Miss Margaret Kaieser, graduate student in botany, University of Illinois, Urbana; Dr. Thomas Kerr, Assistant Cotton Technologist, U. S. Dept. Agr., Washington, D. C.; Dr. Gustav Klem, of the Norwegian Forestry Research Institute, Aas, Norway; Mrs. William

Lake, member Fort Worth Park Commission and in charge of Fort Worth Botanic Garden, Fort Worth, Texas; Mr. Ben Lowenhaupt, graduate student in botany, Iowa State College, Ames; Dr. R. MacVaugh, Assistant Professor of Botany, University of Georgia, Athens; Dr. Paul Mangelsdorf, Vice-Director, Texas Agricultural Experiment Station, College Station; Mr. Ralph O. Marts, of the U. S. Forest Products Laboratory, Madison, Wis.; Mr. J. T. Middleton, Graduate Assistant in Botany, University of Missouri, Columbia; Mr. Henry de la Montagne, Assistant Director, New York Botanical Garden, New York City; Dr. John Adam Moore, Instructor in Botany, Huron College, Huron, S. D.; Dr. E. E. Naylor, Assistant Professor of Botany, University of Missouri, Columbia; Mr. Julian Neill, Teacher of Science, Smithton High School, Smithton, Ill.; Mr. Clark Paris, graduate student in botany, Iowa State College, Ames; Mr. J. H. Pyron, Instructor in Botany, University of Georgia, Athens; Dr. H. W. Rickett, Associate Professor of Botany, University of Missouri, Columbia; Mr. and Mrs. Chris. Schmidt, graduate students in botany, University of Missouri, Columbia; Mr. Richard E. Schultes, of the Department of Economic Botany, Harvard University; Mr. William Schwab, Head Department Science, Madison High School, Madison, Ill.; Mr. Russell J. Seibert, graduate student in botany, Arnold Arboretum of Harvard University; Dr. Hiram M. Showalter, Professor of Biology, Kings College, Bristol, Tenn.; Dr. Jennie L. S. Simpson, Assistant Professor of Biological Sciences, Hunter College, New York City; Dr. E. R. Spencer, Professor of Botany, McKendree College, Lebanon, Ill.; Dr. Julian A. Steyermark, Assistant Curator of the Herbarium, Field Museum of Natural History, Chicago; Dr. Oswald Tippo, Instructor in Botany, University of Illinois, Urbana; Dr. Robert W. Webb, Principal Cotton Technologist, Bureau Agricultural Economics, U. S. Dept. Agr., Washington, D. C.; Dr. Louis Williams, Research Assistant, Botanical Museum of Harvard University; Mr. William Schwab, Head Department Science, Madison High School, Madison, Ill.; Mr. Russell J. Seibert, graduate student in botany, Arnold Arboretum of Harvard University; Dr. Hiram M. Showalter, Professor of Biology, Kings College, Bristol, Tenn.; Dr. Jennie L. S. Simpson, Assistant Professor of Biological Sciences, Hunter College, New York City; Dr. E. R. Spencer, Professor of Botany, McKendree College, Lebanon, Ill.; Dr. Julian A. Steyermark, Assistant Curator of the Herbarium, Field Museum of Natural History, Chicago; Dr. Oswald Tippo, Instructor in Botany, University of Illinois, Urbana; Dr. Robert W. Webb, Principal Cotton Technologist, Bureau Agricultural Economics, U. S. Dept. Agr., Washington, D. C.; Dr. Louis Williams, Research Assistant, Botanical Museum of Harvard University; Dr. F. L. Wynd, Visiting Assistant Professor of Botany, University of Illinois, Urbana; Dr. Mary Goddard, Assistant Professor of Botany, Southern Illinois State Normal University, Carbondale; Dr. G. W. Martin, Professor of Botany, University of Iowa, Iowa City; Mr. R. A. Ryter, Teacher at the Mission

School, Lolodorf, Cameroun, West Africa; Mr. Fred Gibson, Director Boyce Thompson Southwest Arboretum, Superior, Ariz.

Among the groups visiting the Garden during the year were: the botany classes of the University of Missouri, accompanied by Dr. W. B. Drew and Dr. Ilda McVeigh; students in forestry, Purdue University, Lafayette, Ind., under the leadership of Dr. Burr N. Prentice; and the botany students from Moberly Junior College, Moberly, Mo., accompanied by Dr. Esther Adams.

The library also loans books on the interlibrary-loan plan, 150 such loans having been made to 30 institutions during the year.

Statistical Information.—There have been donated to the library or received in exchange during the year 539 books valued at $1,391.53, 1,589 pamphlets valued at $263.05, and five manuscripts valued at $44.00. Two hundred and thirty-nine books were bought at a cost of $1,855.14, and 60 pamphlets at a cost of $131.92. The library now contains 52,820 books and 81,458 pamphlets. There are 344 manuscripts valued at $1,704.40, and 1,052,037 index cards valued at $13,151.99. A total of 12,623 cards were added during the year, of which 2,039 were written by Garden employees, and 10,584 were purchased at a cost of $205.61. One hundred and fifty-one books were bound.

ANNUAL BEQUESTS

The annual flower sermon "On the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom," provided for by Henry Shaw, was preached at Christ Church Cathedral on May 1, by the Rev. Reinhold Niebuhr, of the Union Theological Seminary, New York City.

The Trustees' Banquet Fund was not drawn upon during 1938.

The Gardeners' Banquet Fund was used to provide turkeys for certain employees at Christmas.

Prizes in the form of silver cups, awarded by the St. Louis Horticultural Society, were furnished by the fund for this purpose set aside in the will of Henry Shaw.

ATTENDANCE FOR 1938

(Not including visitors to Arboretum and Tropical Station)

	Week-days	*Sundays*
January	6,619	9,498
February	15,052	20,728
March	12,352	15,623
April	14,687	18,135
May	24,210	17,836
June	22,242	11,625
July	19,331	10,619
August	21,769	9,704
September	17,252	10,044
October	20,563	18,428
November	23,567	26,771
December	8,877	9,098
	206,521	178,109
		206,521
Total		384,630

GEORGE T. MOORE,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1938

GARDEN ATTENDANCE:
Total number of visitors 17,975

LIBRARY ACCESSIONS:
Total number of books and pamphlets bought 30
Total number of books and pamphlets donated 137

PLANT ACCESSIONS:
Total number of plants received as gifts 296

HERBARIUM ACCESSIONS:

By Purchase—
Verdoorn, Fr.—Musci Selecti et Critici, Ser. VI, nos. 251-300 inclusive 50
Verdoorn, Fr.—Hepaticae Selectae et Criticae, Ser. XI, nos. 501-550, inclusive 50

By Gift—
Anderson, E.—Plants of Michigan, Minnesota, and Missouri .. 12
Cutler, Hugh C.—Plants of New Mexico and Texas 66
Goodspeed, T. H.—South American plants, cultivated at University of California Botanical Garden 16
Hubricht, Leslie—Plants of Arkansas 6
Lodewyks, Maude C.—Plants of Wisconsin and Illinois 125
Mackenzie, A. W.—*Iris* sp. 1

By Exchange—	
Demaree, Delzie—Plants of Arkansas	437
Florida Agricultural Experiment Station	19
University of California—Plants of California and Mexico	7
By Field Work—	
Lodewyks, Maude C.—Plants of Missouri	15
Ownbey, Marion—Plants of western United States	2,000
Total	2,804

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXVII FEBRUARY, 1939 No. 2

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BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

TAUSENDSCHÖN ROSES AT ENTRANCE
TO ECONOMIC GARDEN

Missouri Botanical Garden Bulletin

Vol. XXVII FEBRUARY, 1939 No. 2

GROWING ROSES IN ST. LOUIS

The Garden is appealed to so often for information about roses in this locality that the need for another rose bulletin is apparent. Without going into the origin of the various types of roses, this article will be confined to a discussion of the five classes into which practically all of the roses grown in this region may be grouped: the hybrid tea, polyantha, hybrid perpetual, shrub, and climbing roses.

Hybrid Tea Roses.—The hybrid teas commence to bloom in late May, reach their peak in June, rest a little, then have a second blooming period in August which continues until the first hard frost. More hybrid tea roses are planted than any of the other classes. Some forty years ago gardeners were content with the hybrid perpetuals, but these bloomed only in May and June. Many varieties of hybrid teas have been developed until now there are several thousand recorded, but fortunately not all of them are in the trade. The best of these roses retain their place despite the constant threat that the new varieties introduced each year may prove superior. But what would rose growing be without the new varieties to stimulate our interest? For many years we have hoped for dependable yellow bush and climbing roses, and in the last few years we seem nearer that realization. True, we have had yellow climbing roses, as "Aviateur Bleriot" and "Gardenia," but the yellow quickly faded to white in the bright sun. Now we have varieties such as "Doubloons," "Golden Climber" ("Mrs. Arthur Curtiss James"), and the yellow bush roses, "Alice Harding," "Eclipse," "McGredy's Sunset," and "Mrs. Erskine Pembroke Thom," whose flowers are really yellow.

FIG. 1. HYBRID TEA ROSE

FIG. 2. HYBRID PERPETUAL ROSE

Polyantha Roses.—The word "polyantha" means many-flowered. The roses of this class grow from eighteen inches to three feet high, with single or double flowers usually borne in clusters. Polyantha roses produce brilliant masses of color during the entire summer; they are hardy and are adaptable to various kinds of soil. In recent years large-flowered varieties have been created which resemble hybrid tea roses.

Hybrid Perpetuals.—Many years ago hybrid perpetuals were almost the only roses grown. Even now, near very old farmhouses, these plants are sometimes seen in company with the Scotch rose, "Harison's Yellow," and the lilac. Unprotected, they can stand the changeable winter weather better than the hybrid tea roses. The flowers, for the most part, are double, pink, red, or white, with a few partly yellow; some are very fragrant, others slightly so or not at all. The plants are tall, and some varieties have very thorny canes. Their best period of bloom is in June, with only a few varieties, as "Frau Karl Druschki" and "Mrs. John Laing," producing a second crop of flowers in late summer.

THE ROSE GARDEN

BACK-YARD ROSE GARDEN

RAMBLER ROSE "WHITE DOROTHY"

"PAUL'S SCARLET CLIMBER"

CLIMBING ROSE "PURITY"

"PURITY"

FIG. 3. SHRUB ROSE

FIG. 4. LARGE-FLOWERED CLIMBING ROSE

Shrub Roses.—Closely allied to the hybrid perpetuals, in hardiness and vigorous growth, are the various shrub roses, such as rugosa roses, sweetbriers, and the species roses of which our native prairie rose, *Rosa setigera,* is an example.

Climbing Roses.—From the standpoint of size of flower and time of bloom the climbing roses may be divided into two groups: the large-flowered climbers which commence to bloom about May 15, and the small, cluster-flowered ramblers which bloom during the first and second week of June. The climbing hybrid tea roses represent a class that blooms during the summer and fall. They require several years to become established and must be protected during the winter.

Rose Plants.—The experienced rose grower knows when and where to purchase his plants and when to plant them. The beginner is somewhat bewildered by the various kinds offered for sale. Some firms sell small pot roses; during the fall and winter nurserymen and seedsmen advertise dormant field-grown plants and in the spring they offer plants either in clay or tar-paper pots;

department and dime-stores and sidewalk vendors sell roses in sealed packages, or wax-dipped; and late in the spring the so-called "bench-grown" roses, which were discarded by the growers of commercial cut flowers when they replanted their benches, are foisted on the public by unscrupulous dealers.

Rose buds begin to swell in February or March. A period of mild weather in late winter will stimulate the plants into active growth, and many of them are damaged by the frosts which usually follow. Since roses commence to grow very early in the season, for best results the actual planting should be done some time between the middle of November and at the latest the middle of April. Roses may be planted any time during the fall and winter if the ground is free from frost, but if the soil is very wet, planting operations must wait until late February or March. If a rose bed is protected with canvas or boards, planting may be done at any time. When, for some reason, planting has been delayed and the dormant roses have become somewhat shriveled, the entire plants, roots and stems, should be laid in water for twenty-four hours. They are then planted, pruned to two or three eyes, watered, and mounded with soil until growth commences.

About April 10 nurseries discontinue shipping dormant roses and fill the orders with plants growing in paper pots. This increases the cost of transportation, which the purchaser pays. Pot-grown roses may be planted at any time but they must be handled carefully.

Dormant roses in packages, or wax-dipped plants, held in dry store rooms for a considerable length of time, are in a weakened condition when planted. Beware of roses dipped in green wax—they look fresh, but they might be dead.

The Rose Site.—In choosing a location for the rose bed or garden the things to be considered are natural drainage, shelter against the northwest winds, shade, and soil. Roses are benefited by some shade cast by buildings or tall trees but should never be planted close to shallow-rooted trees such as elms and maples. Roses too much shaded the year round are weaker and more subject to disease than those growing in full sun. If they are partially shaded from the western sun by a building or tree, after a hot summer afternoon they will revive and look better than those

"ROSERIE" (IN BLOOM) FOLLOWED BY "DOROTHY PERKINS"

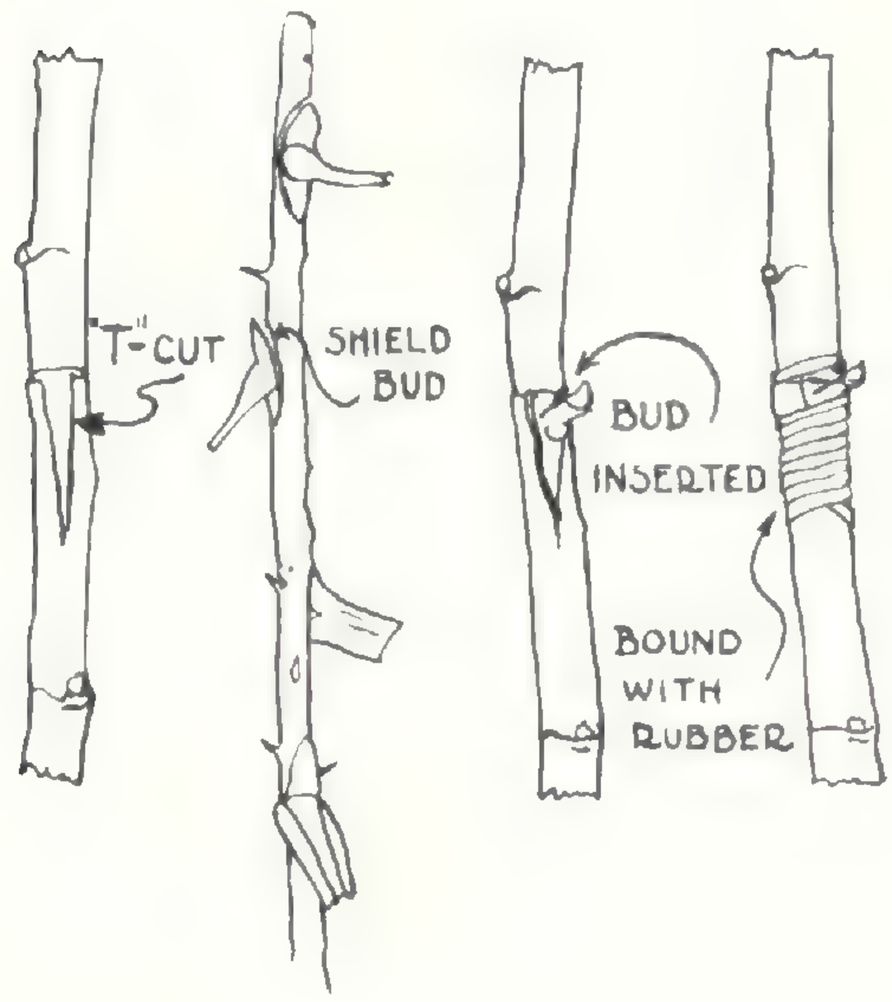
RAMBLER ROSE ON PILLAR AND CHAIN

in full sun, but those growing in the open will be the better plants in the fall.

Preparing Rose Beds.—The best time to prepare rose beds is in early fall, to allow ample time for settling before planting. They may also be prepared during the winter when the soil is not too wet. Roses can be cared for better when grown in separate beds about four feet wide. When there are only a few plants they may be planted in the annual and perennial beds. In making a rose bed the first spade-depth of soil is placed to one side, then the next layer on the opposite side. The third layer is broken up with a spading fork and manure or compost, if available, is mixed with this layer. If the rose bed is in a poorly drained part of the garden the third layer of soil should also be removed, and drainage material, in the form of a six-inch layer of stones, broken bricks, or coarse cinders, placed in the bottom of the bed. When natural soil drainage is extremely bad, a row of drain-tile should be placed at the bottom and gradually sloped to a hole filled with stones. The stones or cinders are then placed over the tile. The last layer of soil removed is the first to be returned to the trench, being mixed with manure or compost. The middle and top layers of soil are then broken up and added. Heavy clay will need more manure or compost than soil in good tilth which has supported other crops. Sand will also improve the texture of very heavy clay soil.

How deep to make rose beds depends upon the type of soil. In good soil eighteen inches is sufficient. Very poor soil should be removed and replaced, at least in part, with soil from another part of the garden or with some purchased from nurseries or landscape contractors. When soil is bought it is well to deal with reliable people or to know its source.

Since it is almost impossible to secure small quantities of good stable or cow manure, the best available source of humus is the compost pile. Any practical gardener will always have a compost pile tucked away in some secluded corner of the garden. Here he can dump the grass clippings, vegetable greens, and leaves. If such a pile is turned several times during the year and watered when dry there will be a constant supply of composted material which, when supplemented with the commercial fertilizers, is a good substitute for manure.



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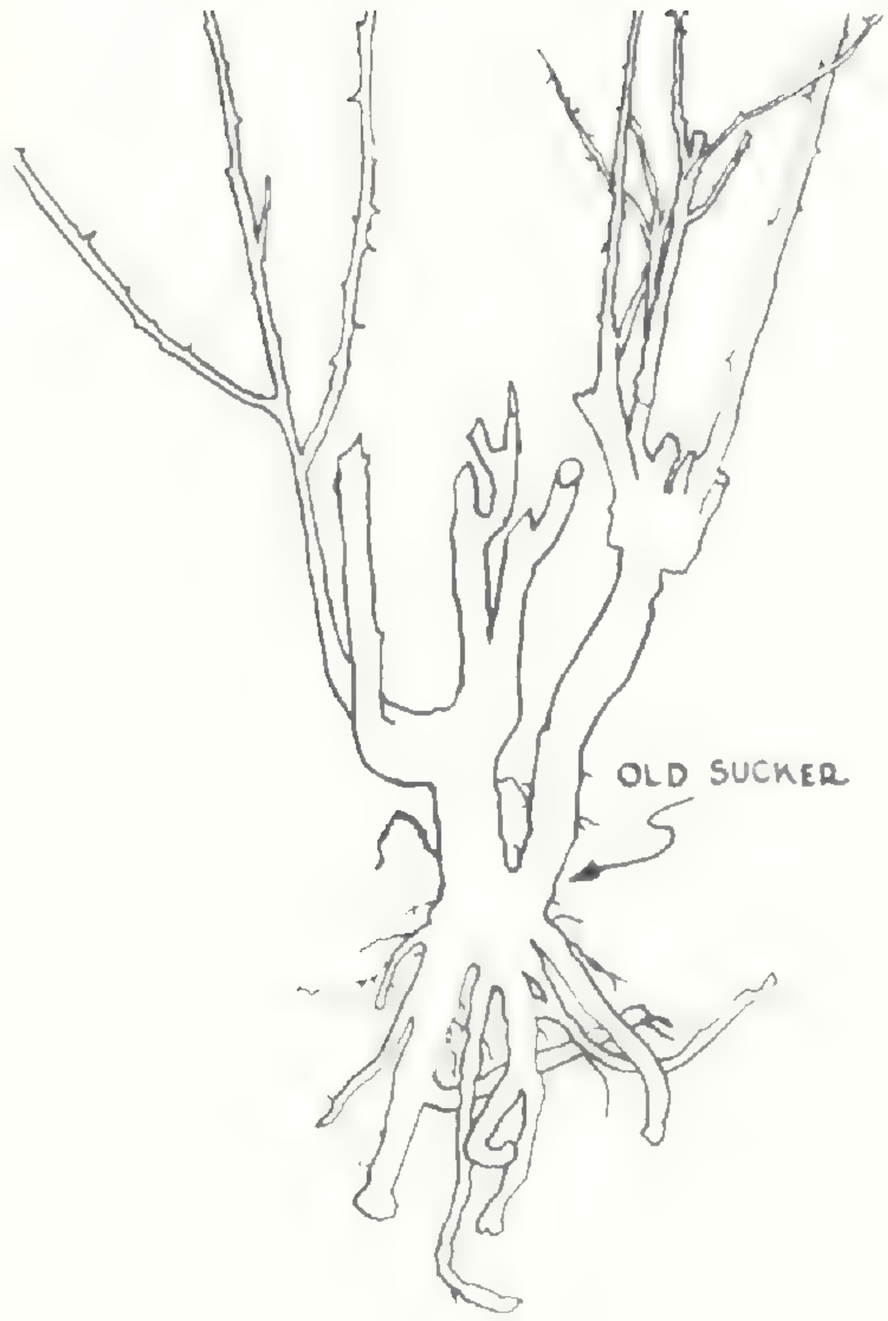

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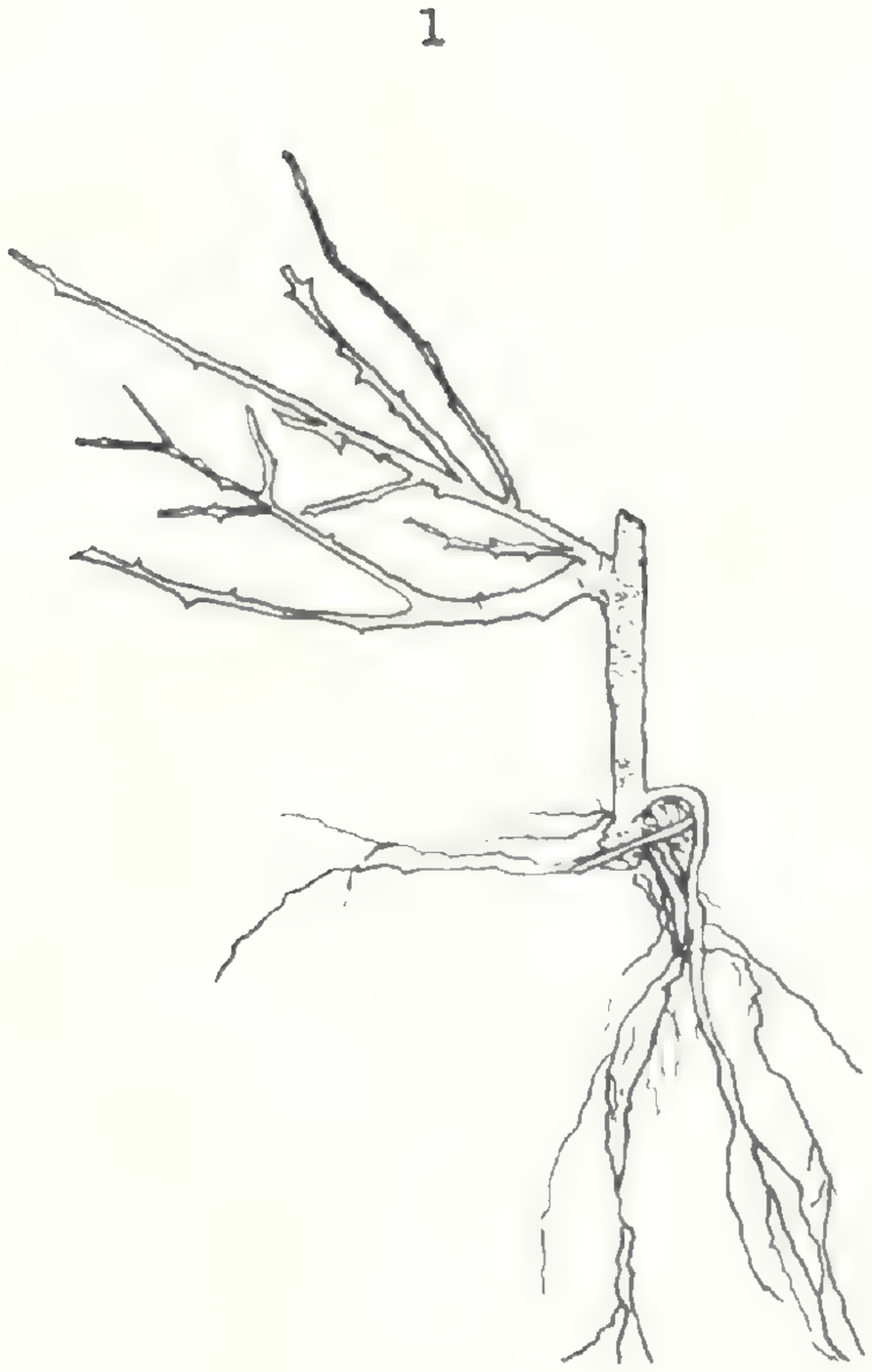

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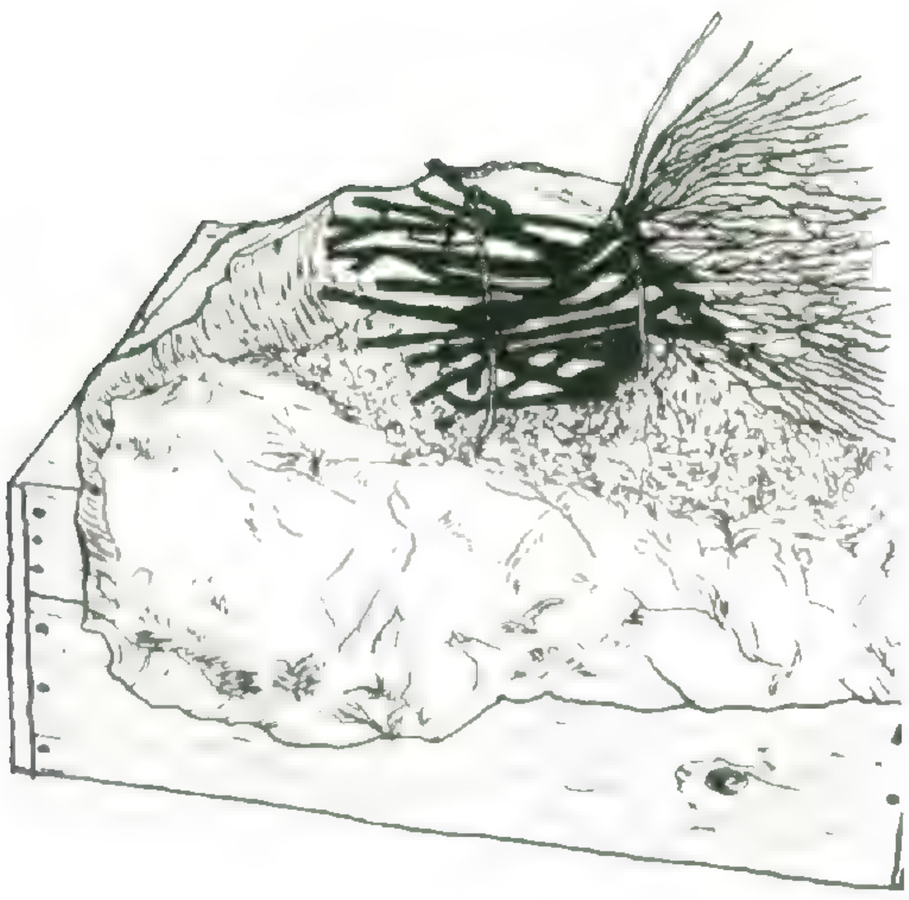
BUDDED ROSES

1. THE BUDDING PROCESS.
2. ROSE PLANT WITH AN OLD SUCKER.
3. BUDDED ROSE—NO. 3 GRADE, ALL BRANCHES ORIGINATE FROM ONE BUD.
4. SUCKER THAT SHOULD BE REMOVED.



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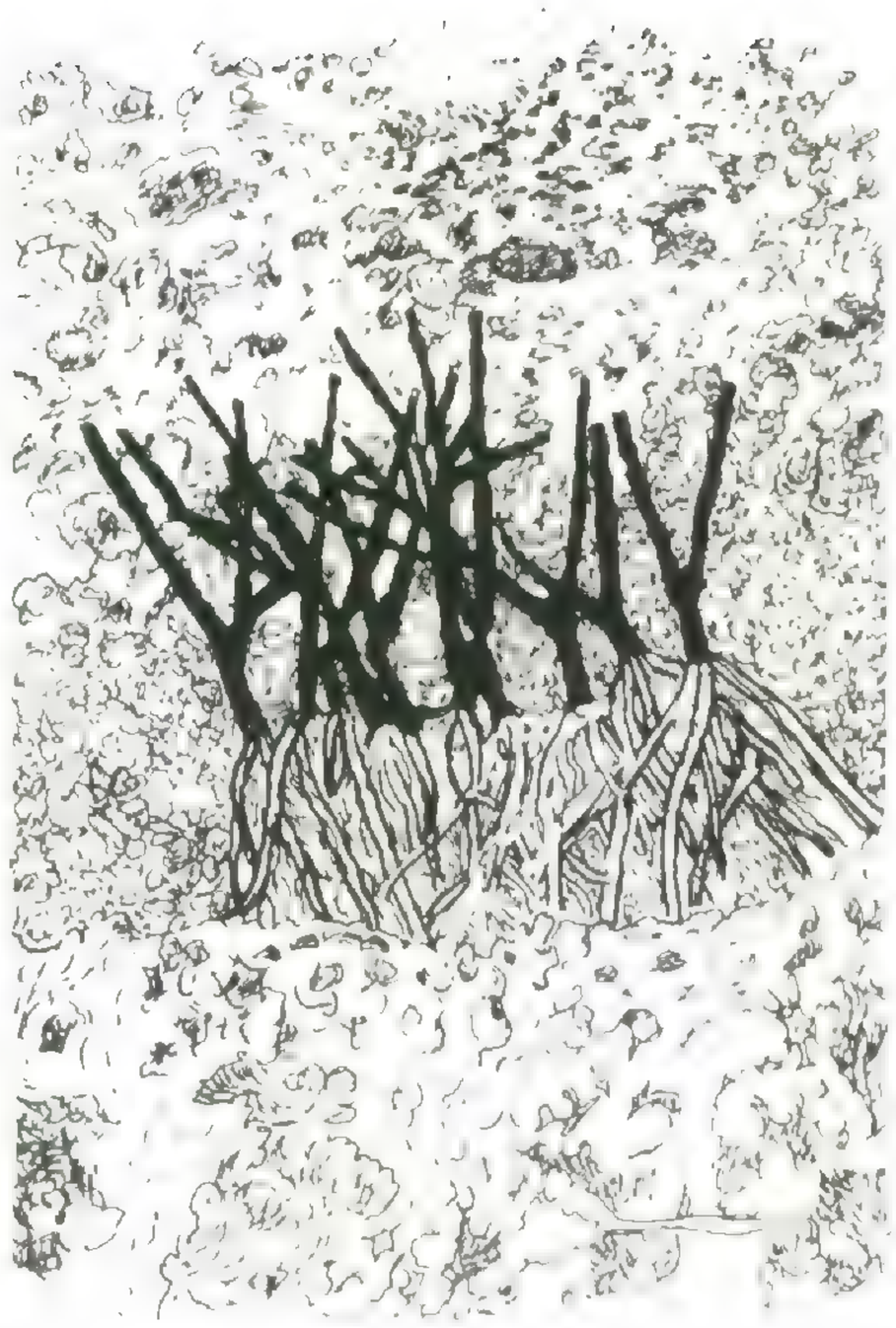

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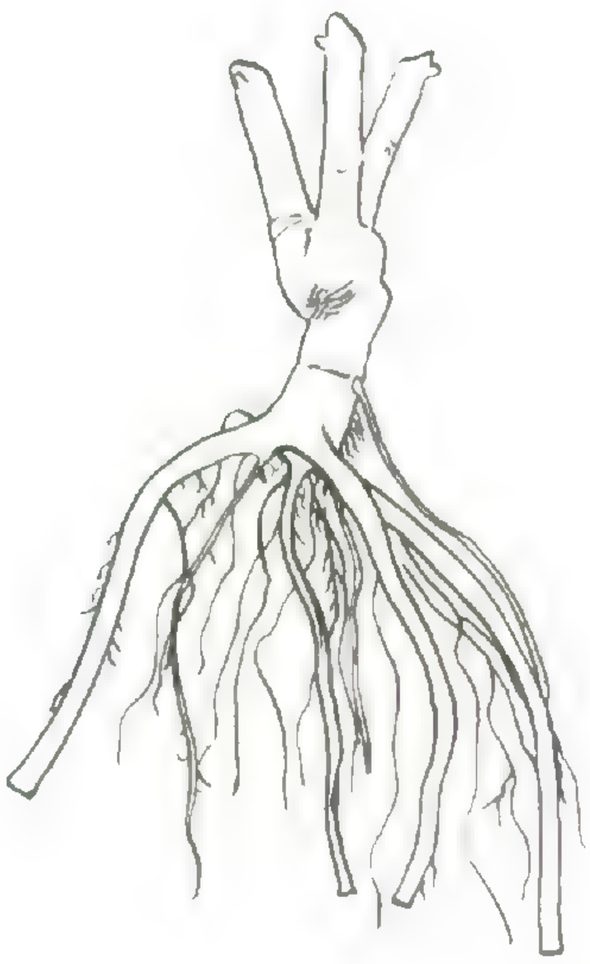

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1. UNPACKING ROSES.

2. "HEELING IN" ROSES.

3. WHITE FEEDING ROOTS.

4. DORMANT ROSE PRUNED READY FOR PLANTING.

Budded Roses.—The majority of roses purchased are budded plants (fig. 3 of pl. 6). Strong-rooted roses are grown in nursery rows as stock plants, then individual buds from the named varieties are inserted on the collars of the stock plants. This is known as budding. These roses are lifted in the fall of the second year and shipped to the dealer or are held in storage until spring. Since all the top branches originate from the one bud, it can readly be seen (figs. 1 and 3 of pl. 6) that the upper part of the rose is of a named variety, and the root system is from an entirely different rose. An odd shoot appearing several inches from the base of the plant is striking enough to be distinguished easily from the good variety (fig. 4 of pl. 6). Such canes grow very rapidly, usually have more leaflets, and the stems may or may not be very thorny. Whenever suckers appear, remove some of the soil and cut them as close to the root as possible. Of the many roses that are grown, the proportion of plants that sucker is very small.

Ordering and Receiving Dormant Roses.—Dormant roses should be ordered in the fall or soon after the new year. Plant them immediately on arrival. If this is not possible, the package should be opened and the roses "heeled in," that is, placed in a trench with the roots and a portion of the stems covered with moist soil. Trees and shrubs for future planting are handled in the same way. At the first opportunity, when soil conditions are right, in February or March, these heeled-in roses should be planted. The experienced gardener instinctively knows when the soil is fit for planting, but the novice must determine this by trial. If the soil gums and balls and sticks to the spade and shoes, he should wait several days. Roses that are not planted by the end of March will have produced many fine white hair roots in their temporary trench. When such roses are lifted all these feeding roots are broken and the plants are forced to produce a new set. This checks the growth of the roses and is one of the reasons that early planting is a paramount consideration to successful rose culture.

Planting.—Roses received from the nursery should be unpacked in a sheltered and shaded spot. Sun and wind quickly dry out the roots and if the plants are left exposed for only a short time they suffer and sometimes die. After removing any

broken stems and roots, dip the roses in a pail of water and protect them with a damp sack until planted.

The hole to receive the rose should be large enough to accommodate the roots without crowding. Leave a slight mound in the center and on this set the rose so that the knob (the place where the rose is budded) is just about an inch beneath the surface of the soil. If, due to the lateness of the season, roses must be planted soon after the bed has been prepared, it should be remembered that the entire bed will settle for several months. Roses should be planted a little higher in a new bed, and later, if necessary, additional soil is placed around the plants. Work the soil between the roots with the hands. (A good pair of leather gloves will be found indispensable for this work.) Add more soil and finally firm with the feet. Roses planted in February and March seldom need to be watered after planting, but later in the season each rose should be given half a pail of water. After this has penetrated, additional soil is mounded around the base of the plant to protect it from sun and wind. Later this soil is washed down by rains or leveled off during cultivation. If the plants are weak the canes should be shortened to six inches or even less. This may be done before or after planting.

Planting Distances.—The dwarf polyantha and the majority of the hybrid tea roses should be planted fifteen to eighteen inches apart; large hybrid tea roses, as "Radiance," two feet; hybrid perpetuals, two to three feet; and rugosa and shrub roses at least four feet apart. Climbing and rambler roses are planted singly at the bases of arches or pillars. On fences or trellises they should be spaced eight to ten feet apart, while unusually strong-growing varieties, as "Dr. Van Fleet," may be even further apart.

Watering.—Rains usually supply enough moisture in the spring, but during the dry period from mid-June until late August roses must be watered. The time of the day for watering in midsummer makes little difference, although there is some possibility of aiding the spread of mildew and black spot if the foliage remains wet during the night. However, heavy dew may bring about this same condition. From six to eight o'clock in the morning is a good time to water the rose garden. There is no harm done if the roses are watered during the day except that the moisture

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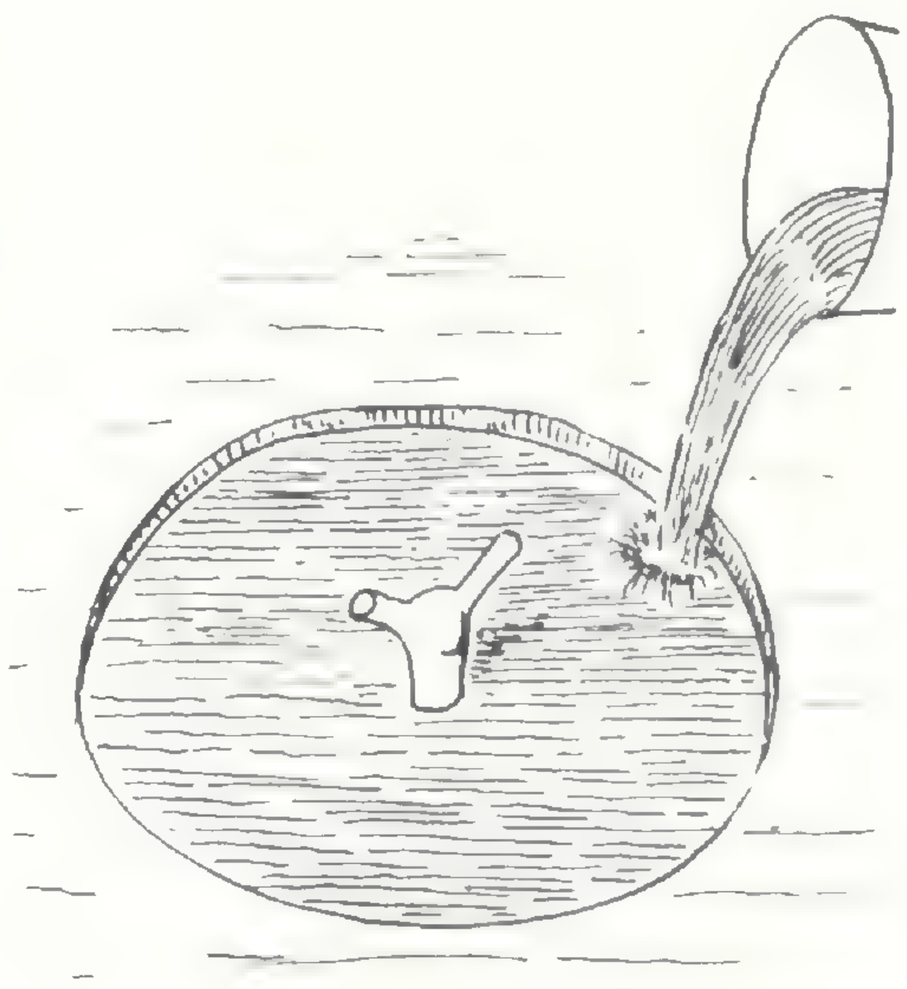

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PLANTING A DORMANT ROSE

evaporates more quickly then. A thorough soaking once or twice a week should carry the plants through the dry periods. Roses require three waterings during a week of windy, ninety-degree weather.

Insects.—Chewing insects, such as the various caterpillars, worms, and bugs, eat the leaves and sometimes the flowers. The best spray material for such insects is arsenate of lead—a tablespoonful to a quart of water. Make a paste with the powder and a little water, pour the mixture into the spray tank, and add the full amount of water. Spray the rose foliage with this solution when the caterpillars and bugs appear, which is usually during May and June. If it is washed off by rain repeat the spraying. In some years small green worms skeletonize the leaves of the climbing roses. Direct the insecticide to the under-side of the leaves where these worms are feeding.

Nocturnal insects, such as the June bugs, cannot be killed with ordinary insecticides. Usually they cause little harm, but if they do, many of them can be caught with the aid of a flashlight and dropped into water and kerosene.

Figure 4 of plate 9 shows a form of stem injury caused by borers. As will be seen, these borers enter the stem where it has been pruned. If there are many borers the injured canes should be cut off and burned. When the damage is slight the removal of the canes may be postponed until the following spring when pruning the plants.

Some years, especially in spring, the aphis, one of the sucking insects, becomes very numerous. They are easily controlled by spraying with one of the nicotine or pyrethrum sprays. The rugosa roses are subject to various scale insects, such as oyster shell and scurfy scale. When the entire cane is covered with scale it should be cut away at the base and burned. These roses should be sprayed with one of the oil sprays during the winter.

Red spider (fig. 2 of pl. 9) is a pest that thrives under city conditions. It causes partial defoliation of the roses during June and July and during dry summers also attacks many other plants such as wisterias, philadelphus, horse-chestnuts, and buddleias. These mites, which can be seen with a lens on the under-side of the leaves, suck the plant juices. Some degree of control may be

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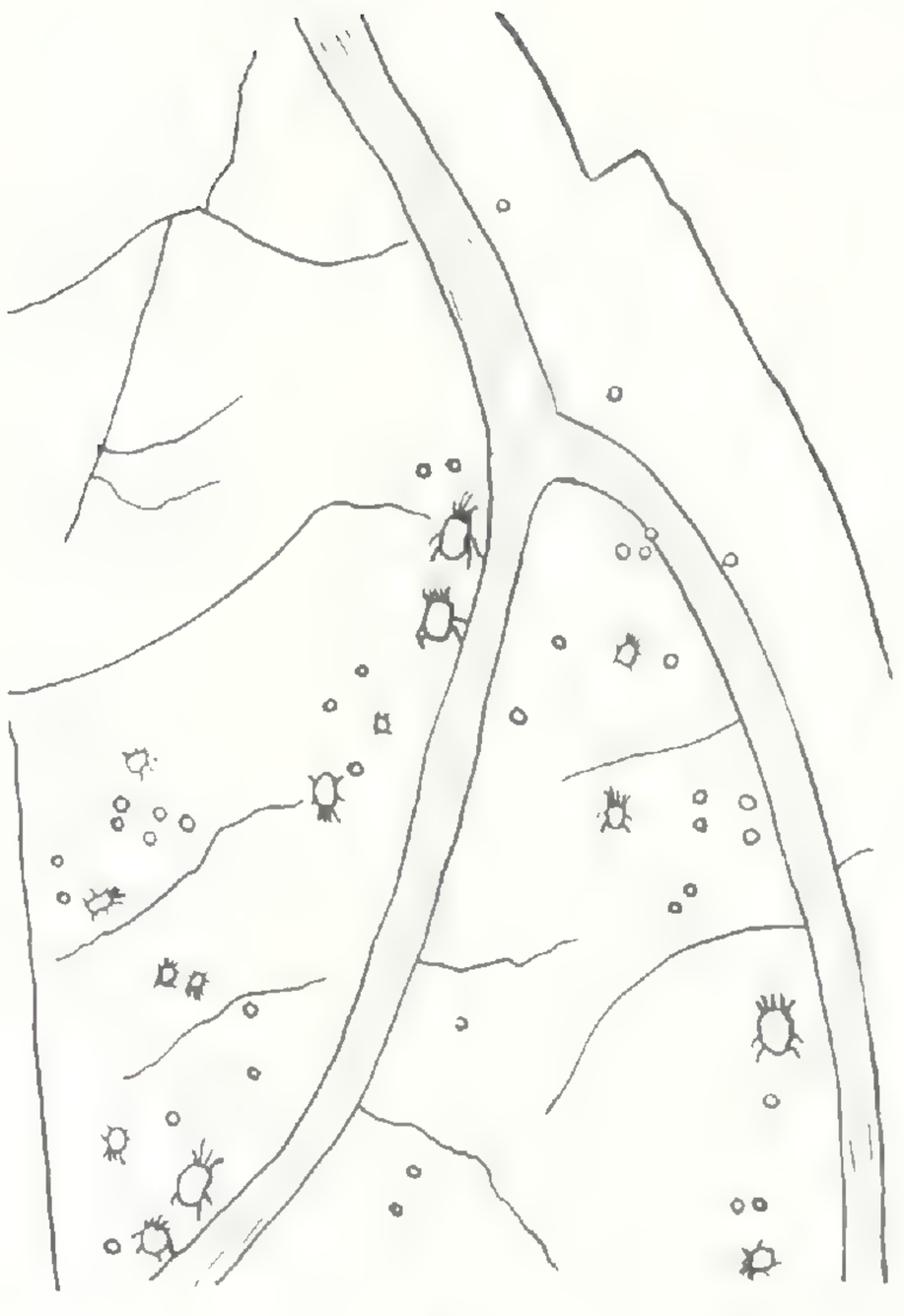

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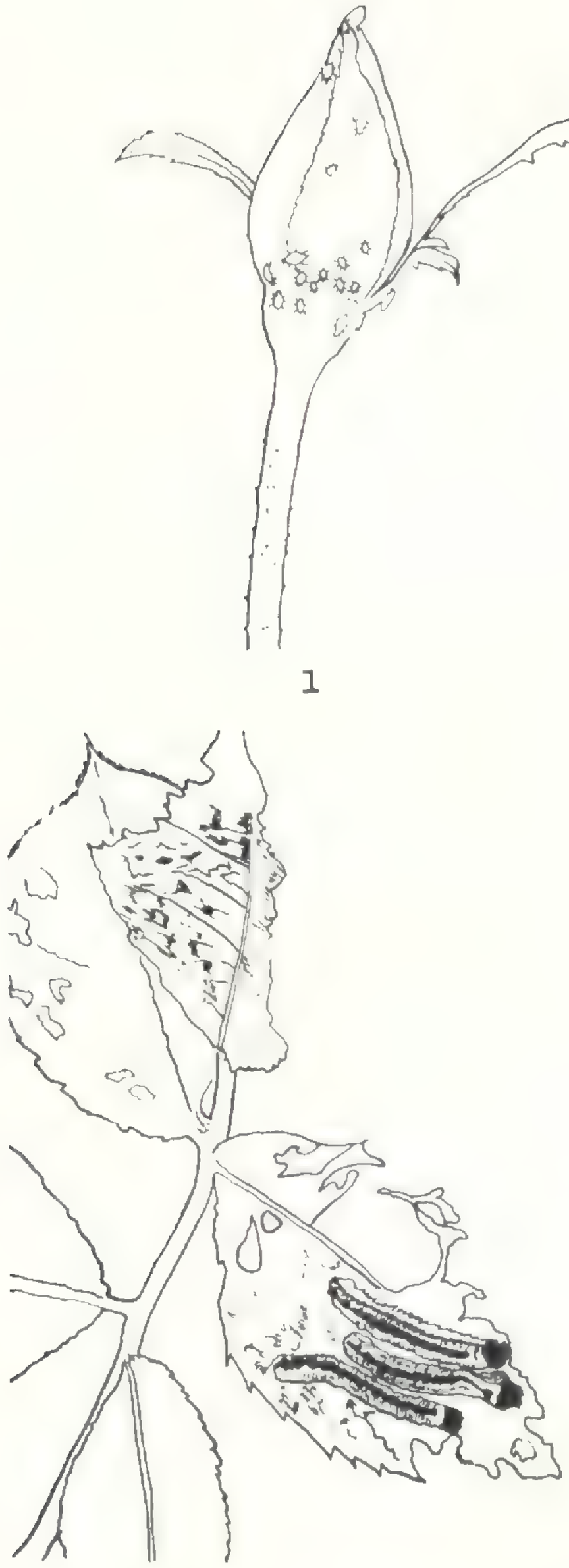

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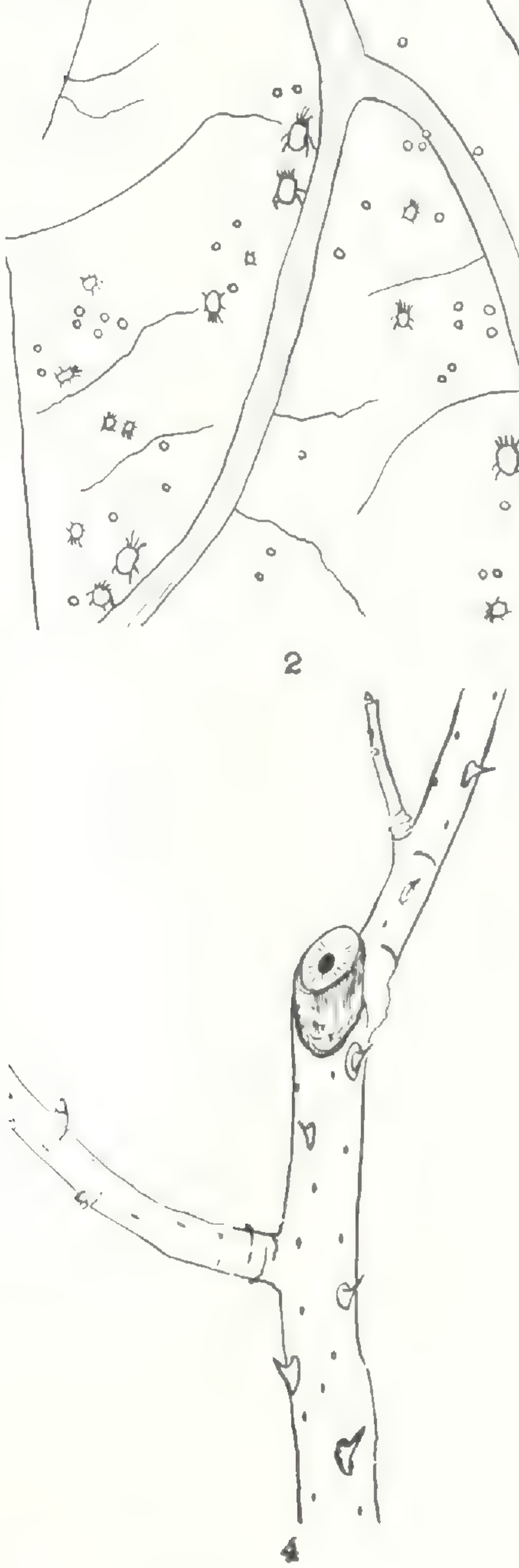


4

INSECTS

1. APHIS.

2. RED SPIDERS (enlarged).

3. CATERPILLARS.

4. ROSE CANE SHOWING WORK OF BORER.

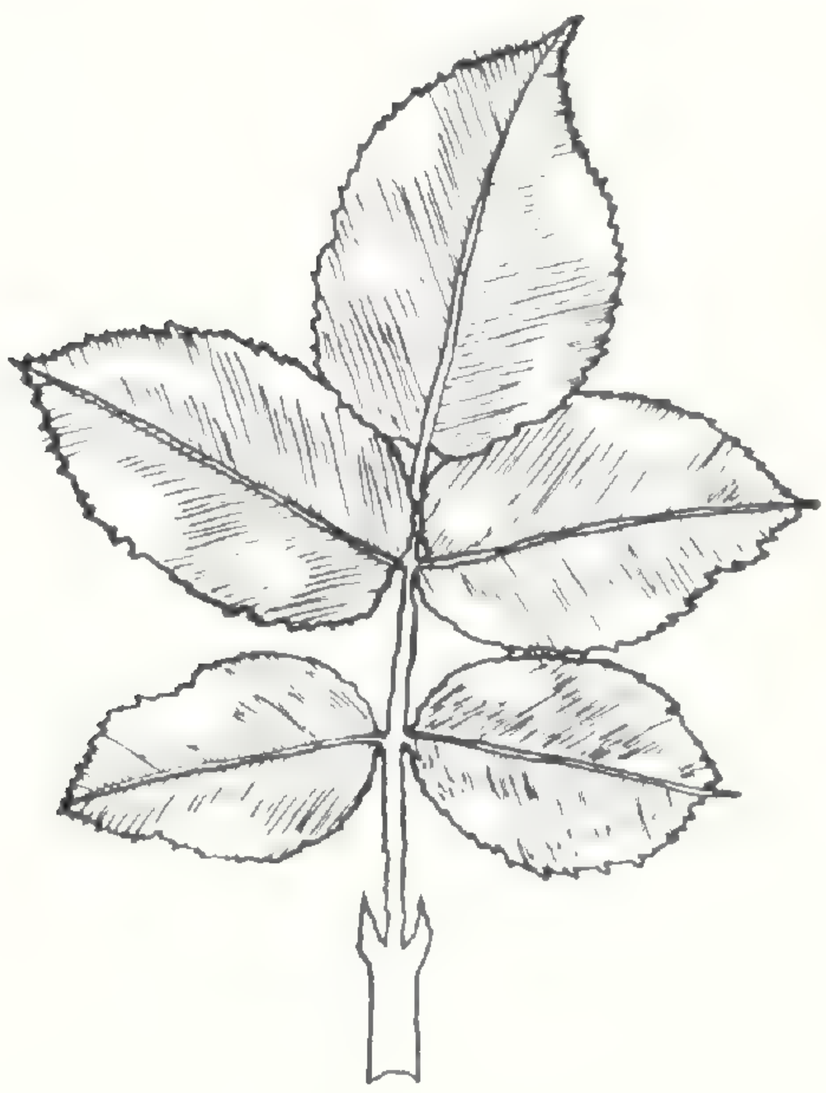
secured by syringing the under-side of the leaves with a forceful spray of water.

Diseases.—Mildew is the white, powdery substance that forms on the leaves and flower buds. It affects the foliage of the rambler roses more than any of the other groups. It may become quite serious in spring and again after mid-summer, when the nights are cool and the dew heavy. It is controlled with the same dusts or sprays recommended for black spot.

Black spot is a fungus disease which may be recognized by the circular, reddish-brown spots which form on the rose leaves. The fungus develops early in the season, but its presence is not noticed until the blotched leaves begin to drop in August. Rose growers become alarmed and ask for a cure when their plants are being defoliated, but then it is too late. The fallen leaves should be gathered and burned as they contain innumerable spores which will infect other roses.

There are several materials that may be used to combat mildew and black spot. The liquid spray materials are Bordeaux mixture and Tri-ogen, the latter spray also controlling the insects. Bordeaux mixture is effective but it sometimes burns the foliage and always leaves a bluish cast. Dusting materials are Massey dust, a dust composed of nine parts sulphur and one part of arsenate of lead, straight dusting sulphur, and Pomo-green, which is a green-tinted Massey dust.

Dusting and Spraying.—Commence early in the spring and dust or spray all of the climbing and bush roses at least every two weeks, more often if the rains are frequent. Apply the spray before a rain if that time can be anticipated. If a protracted hot and dry spell occurs in June and July, discontinue dusting as sulphur injures the foliage during hot weather. The liquid sprays also should be used less frequently. With cooler nights and occasional showers in August the diseases will spread unless checked by the regular dusting and spraying. When black spot defoliates bush roses in August and September it is the result of neglect or irregularity of the applications. Black spot rarely attacks climbing and rambler roses. The ramblers are very subject to mildew and should be dusted in the spring and again in August and Sep-



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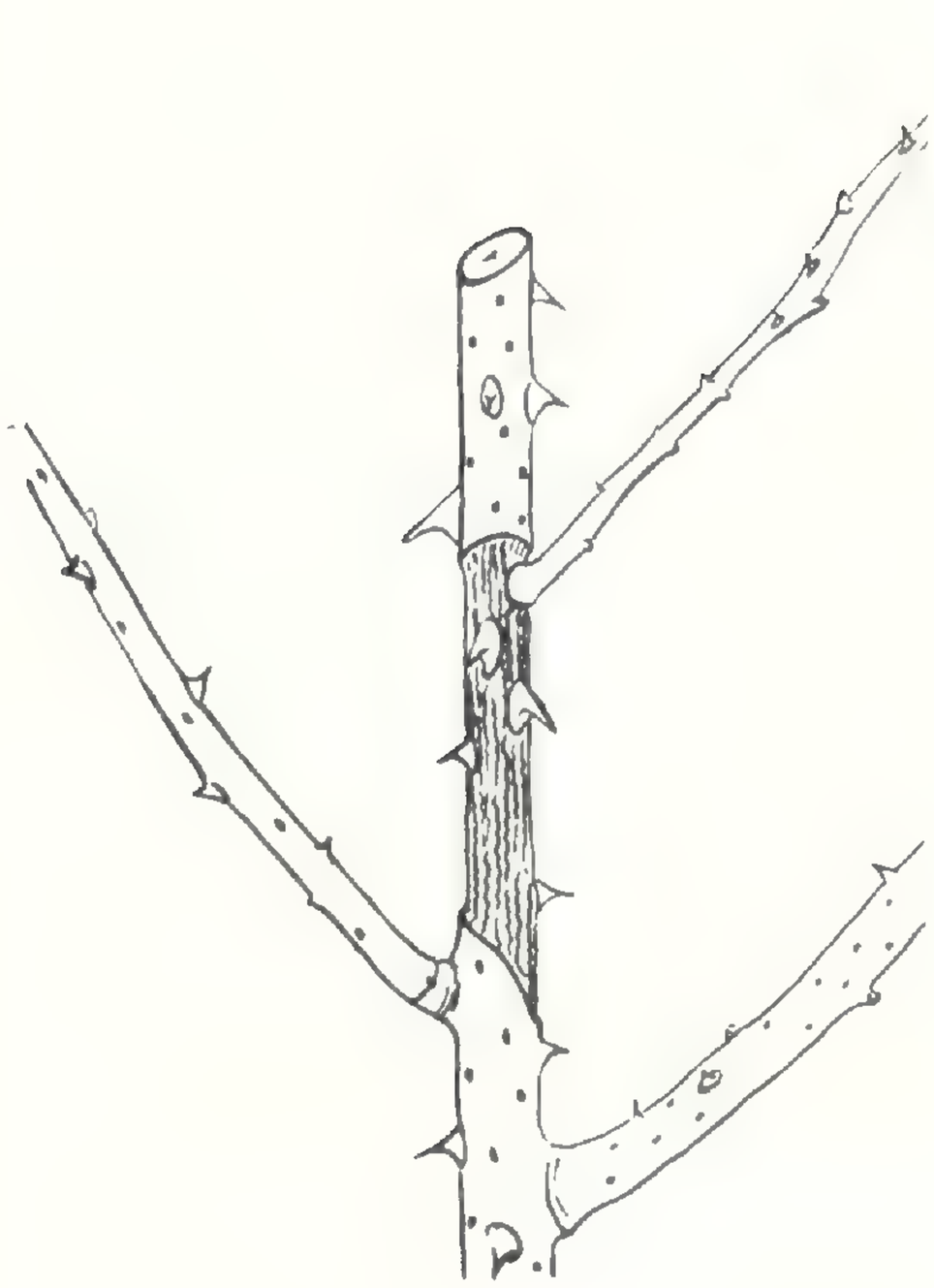

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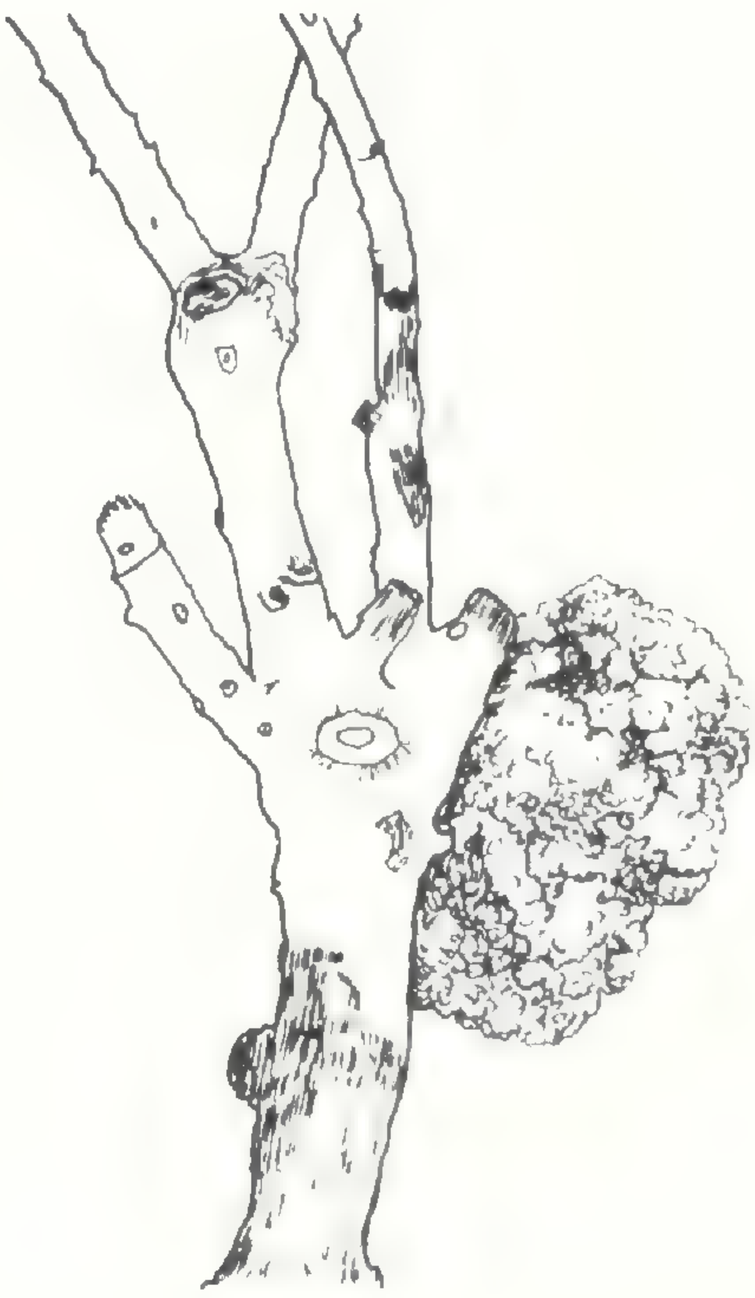


4

DISEASES

1. MILDEW.
2. BLACK SPOT.
3. STEM CANKER.
4. CROWN GALL.

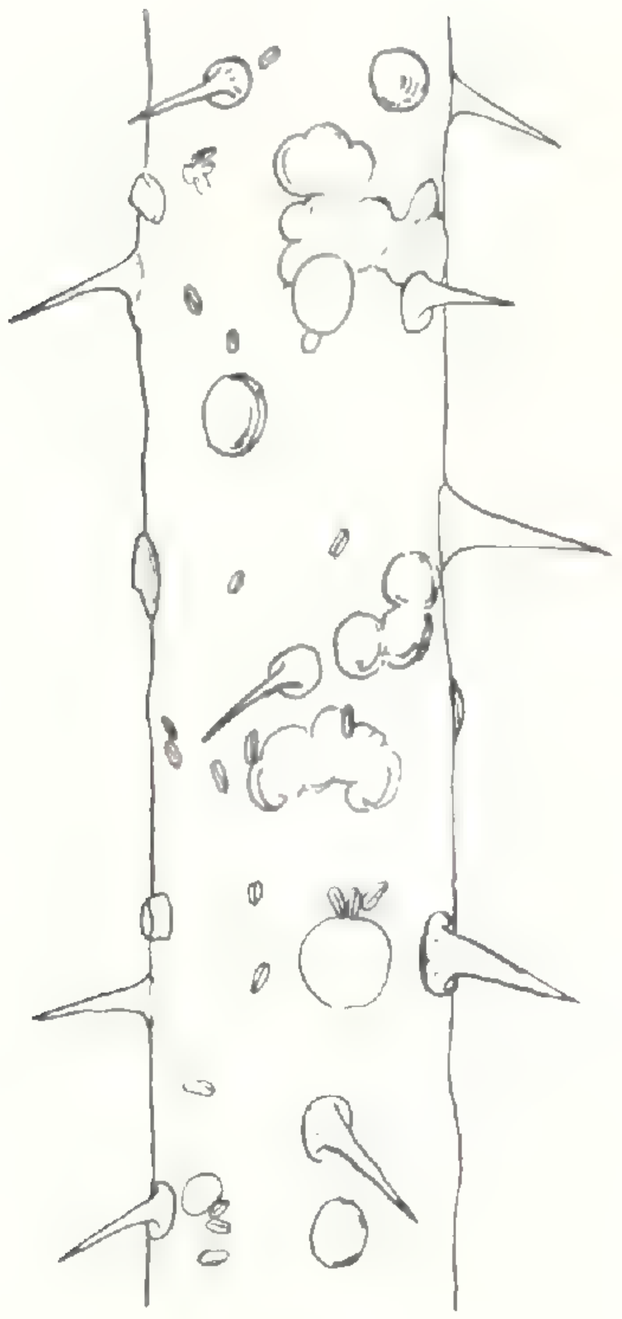
tember. Should mildew become serious a thorough spraying with Bordeaux will check it.

A good sprayer should cover all of the foliage with a fine mist. Various dust guns are on the market. The small hand dusters are good for caring for a few roses but for the larger rose garden one of the bellows or blower dusting guns will be found much more efficient. Roses should be dusted in the morning or evening when there is little wind. Better distribution of the sulphur is effected when the foliage is dry. If the dust is directed to the under-side of the leaves, enough of it will settle on the upper surface. A pair of close-fitting goggles will prevent the eyes from smarting while dusting, and respirators are also sometimes used in this work.

Stem canker is caused by a fungus which discolors and sometimes girdles the stems. No cure is known for this disease but all discolored wood should be cut and burned.

Figure 4 of plate 10 shows a crown gall. Such diseased growth is seldom discovered until roses are transplanted. There is no certain cure, and even though it is cut away there is danger of infecting other roses. When it occurs it is best to destroy the plant. The exact cause of this disease is not known but it is thought to be more prevalent on alkaline soil, the infection starting at a root or stem injury.

Fertilizing.—Manure is practically unobtainable in a large city, and when some is located it is of doubtful quality or may even injure the roses. Dried cow and cattle manure may be purchased from nurserymen and seed-stores. A thin layer of this should be spread on the rose beds in early spring and worked into the soil. Commercial fertilizers may be used for subsequent feedings. Domestic and foreign peat, humus, and leaf mold may be purchased in 100-pound bags. A light dressing of any one of these materials should be worked into the soil in the spring to counteract any deleterious effects of commercial fertilizers. Humus from the compost pile would also be good organic material for rose beds. In a suggested feeding schedule a commercial fertilizer, such as the nationally advertised "Loma" and "Vigoro," should be given at the time the roses are uncovered in late March or early April. A heaping tablespoonful of this fertilizer should be spread around each rose and stirred into the soil. Large roses and



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1. SCURFY SCALE ON RUGOSA ROSE.
2. COMPRESSED AIR SPRAYER.
3. SMALL DUSTER.
4. LARGE DUSTER WITH BELLOWS.

climbers should be given a handful of fertilizer. These applications should be repeated each month, but in diminishing amounts, and should stop at the end of August. Rose growers throughout the United States are testing various kinds of fertilizers and their results are reported in *The American Rose Annual*. Since the gardening world has become "pH" conscious, roses are also being experimentally grown in alkaline and acid soils.

Summer Mulching.—To mulch or not to mulch must be decided by the grower. In many rose gardens the soil is cultivated periodically to kill the weeds. This operation creates a dust mulch which helps to conserve the moisture. When many roses must be cared for it becomes a laborious task as it must frequently be repeated after each rain. An artificial mulch during the dry and hot months prevents weeds, conserves moisture, and insulates the soil against the hot rays of the sun. Mulching materials that may be used are peat, buckwheat hulls and spent hops. About a two-inch layer of any of these materials should be applied to the rose beds in early June and left until the end of August or early September. Mulching material should not be heaped around the base of the roses as the stems are sometimes burned when it is damp and hot. Some growers contend that artificial mulches aid the spread of black spot.

Pruning Climbing Roses.—The term "climbing roses" is applied to the large-flowered varieties whose flowers are borne on laterals a foot or more long. These roses do not produce numerous canes from the base of the plants each year but many of the new growths start from the two-and three-year-old canes. The "rambler" roses, "Dorothy Perkins," for instance, annually produce many strong and fast-growing shoots from the base of the plant. Both climbers and ramblers should be pruned during the summer. The large-flowered kinds should be thinned so that half of the remaining wood is two or more years old and the other half of the current season's growth. Varieties, as "Dr. Van Fleet," grow so rapidly after the summer pruning that it becomes necessary to do some additional thinning in the spring.

It might be well to pause for a moment in the discussion of pruning to say a few words about the pruning tools. The pruning shear is used more than any other tool. It should be strong, made

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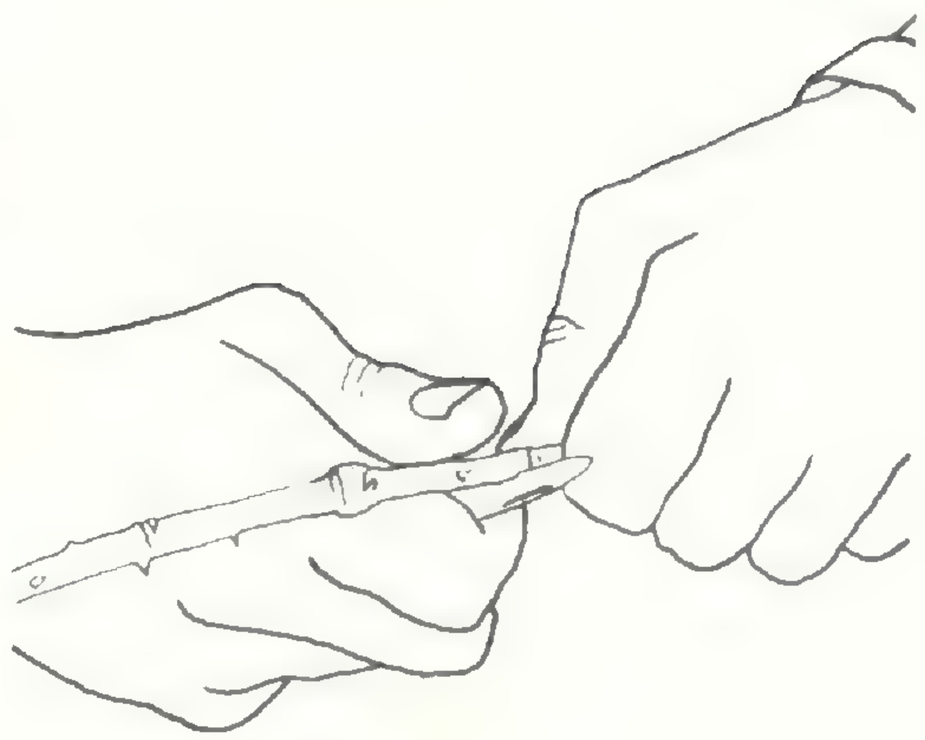

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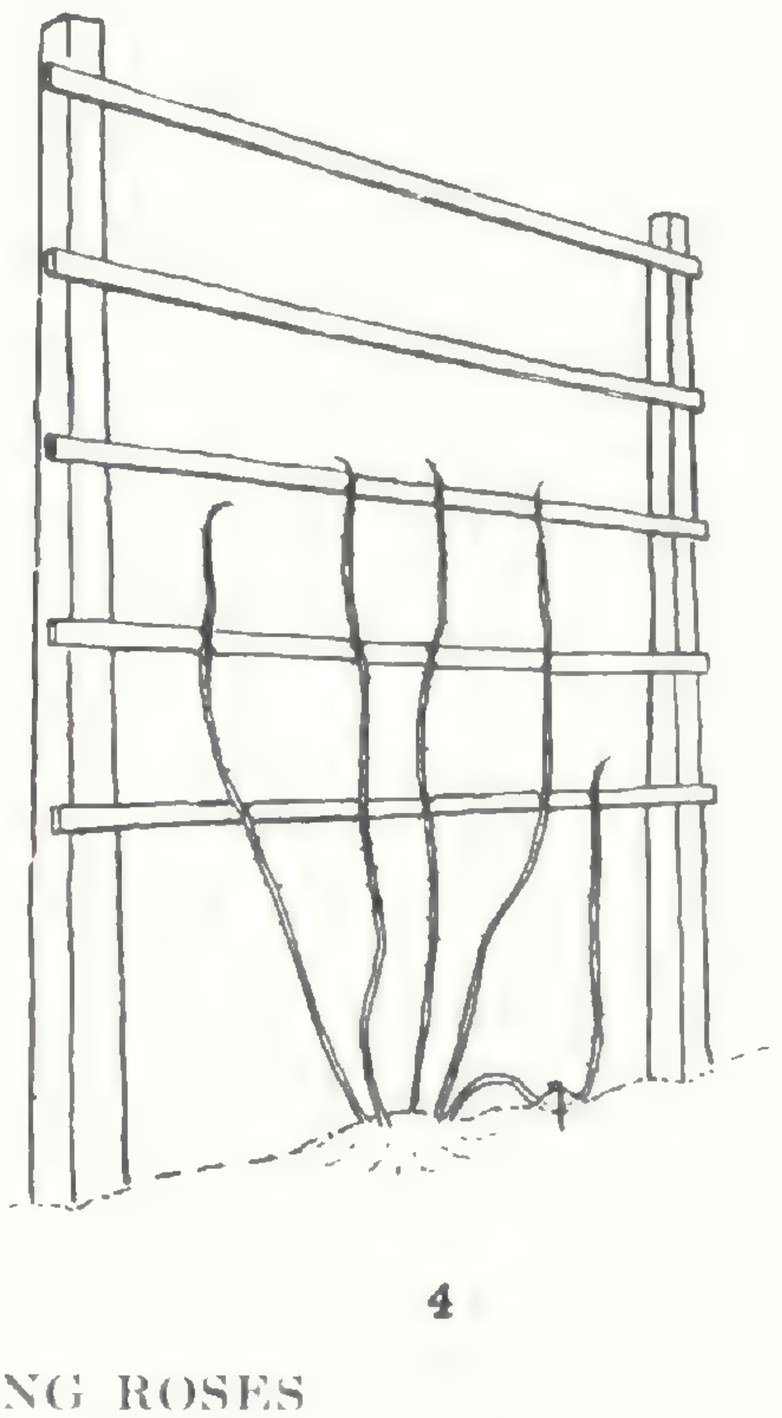

4

PROPAGATING ROSES

1. CUTTING WOOD.
2. MAKING CUT BELOW A BUD.
3. CUTTING UNDER GLASS JAR.
4. LAYERING A CLIMBING ROSE CANE.

of good steel, and may be either single-edged or double-cut. To cut canes a half inch or more in diameter, a lopping shear, with 24-inch handles, is the proper tool. Climbing roses are thorny and have a nasty way of catching in clothing. The lopping shear will be found indispensable in picking up long and unruly canes and dragging them away. When it is impossible to cut heavy basal canes with a lopping shear, because of the crowded condition of the stems, a key-hole saw is the tool to use.

In pruning rambler roses, all of the canes which bore flowers in June should be removed. There will be many new canes at the base of the plants to replace them. Such treatment seems drastic, but it is surprising how fast the new shoots grow. Before pruning, all of the canes should be removed from the trellis and laid on the ground. The old canes are then severed at the base and the new ones tied in place. When the ramblers are badly tangled, the old canes must be cut away in sections. It may be stated at this point that if rose canes have been tied to one side of the trellis, instead of being woven between the bars, it is much easier to remove them before pruning. Ramblers on large arches or trellises are not pruned so severely.

Propagating Roses.—A great deal of the interest and fascination of roses is centered in their propagation, and nearly all rose growers practice it with varying results. Some of the climbing, polyantha, and strong-growing bush roses grow as well on their own roots as the budded plants. Many of these roses are rooted by the popular Mason-jar method. The cuttings are usually made in the autumn from blooming wood. About three inches of the stem immediately beneath the spent flower is cut away, the next six inches of wood yielding a good cutting. The basal cut is made immediately beneath a bud. Remove all leaves except the upper two or three. A rose leaf is a compound leaf, each leaf being composed of five or seven leaflets, although the number is variable. When it is said that all of the leaves, except the upper two or three should be removed, the statement refers to the compound leaves and not the leaflets. Several additional cuttings can usually be made from the same stem. These cuttings are inserted at least two inches deep in light soil and covered with a glass jar pressed into the soil. When colder weather occurs some additional

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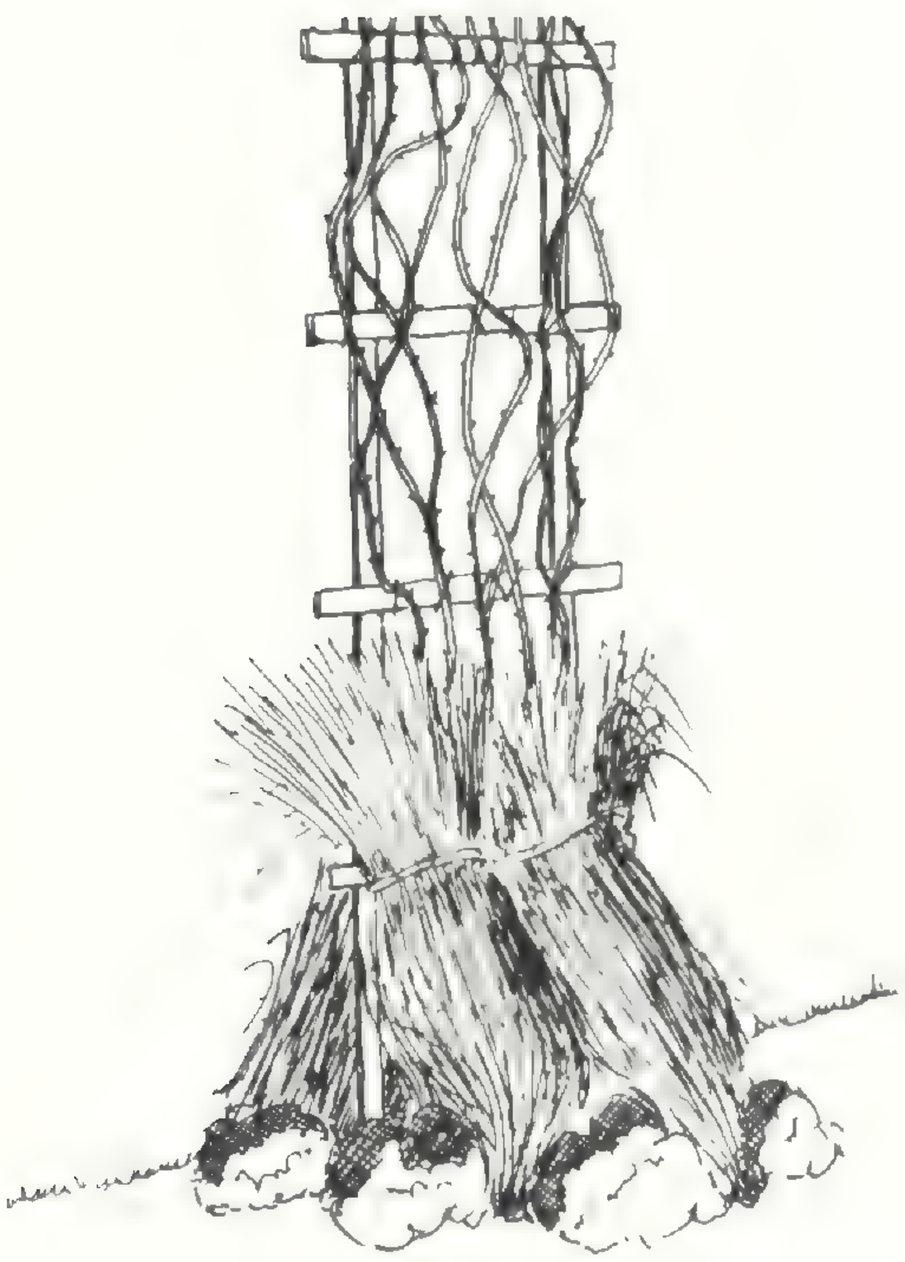

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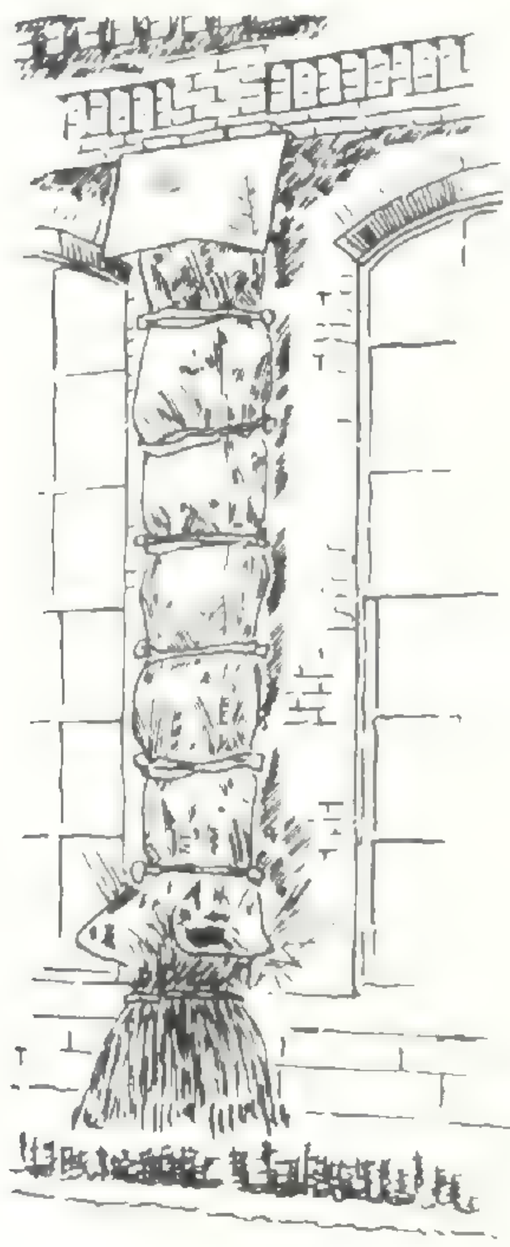

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WINTER PROTECTION

1. HILLING SOIL AROUND BASE OF ROSES.
2. A STRAW MULCH.
3. PROTECTING BASE OF CLIMBING ROSE.
4. ENTIRE CLIMBING ROSE PROTECTED.

soil is heaped around the base of the jars. The cuttings may be placed in a spot where the rose bush is to grow or they may be started in a specially prepared bed and transplanted a year later. They are kept under the jar during the fall and winter but in late April or May they are gradually hardened by removing the jar a few hours each day. The young plants should be shielded from the sun and the wind for several days following removal of the jar.

Roses may also be grown from cuttings made in June, or August and September. Such cuttings are made three to four inches long, from firm, twiggy wood, with one leaf at the top. Wood the thickness of a lead pencil will not root. Root growth is promoted by the use of substances like "Hormodin A," "Root-Gro" and "Rootone." Not more than five units of "Hormodin A" should be used, as rose cuttings burn easily. Summer cuttings are inserted in flats or pans of sand and placed in a cool and shaded spot. Meramec sand packs tightly and does not need as much water as the coarser Mississippi River sand. Spray the cuttings several times a day the first two weeks and always shield them from the wind with cloth or paper. After the third week some varieties will have rooted, and these are potted when the roots are at least half an inch long.

Climbing roses can be rooted by layering. This may be done in early spring by bending some of the long canes to the ground and covering the bent section with six inches of soil. A piece of wire, shaped like a hair pin, will hold the stem in place. The loose end of the cane is tied to a stake or the trellis. In March of the following year the cane is severed from the parent plant and set in its new location. Climbing roses will root more quickly if a cut is made half way through the stem and a small stone inserted in the cut surfaces, before it is pegged down and covered. They also root easily from thin, but firm, greenwood cuttings.

Winter Protection.—About mid-November the soil should be hilled up around the base of the hybrid tea roses, with the work completed by Thanksgiving. Soil from the border of the bed and from between the plants is used. This is the best way to protect hybrid tea roses, but additional protection can be given when material is available. Baled straw is useless as most of it is too

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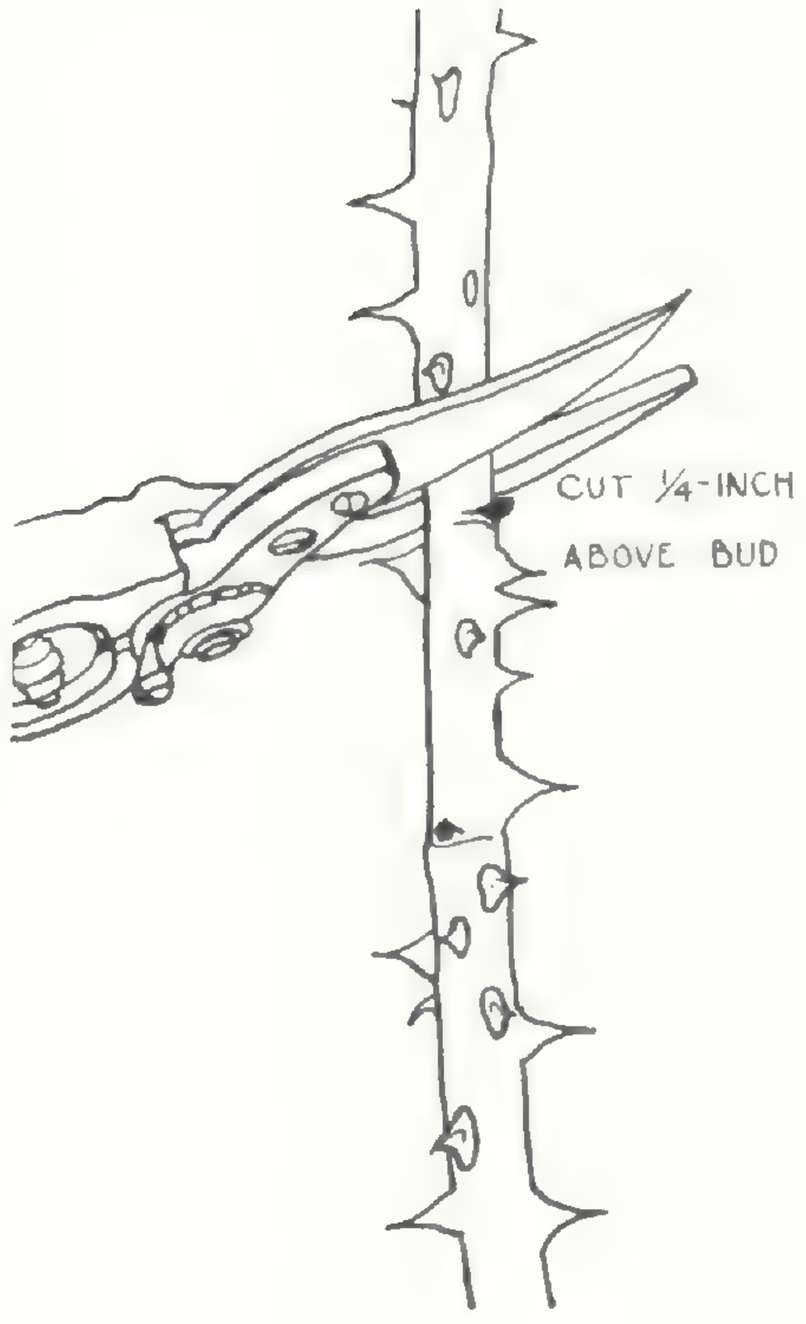

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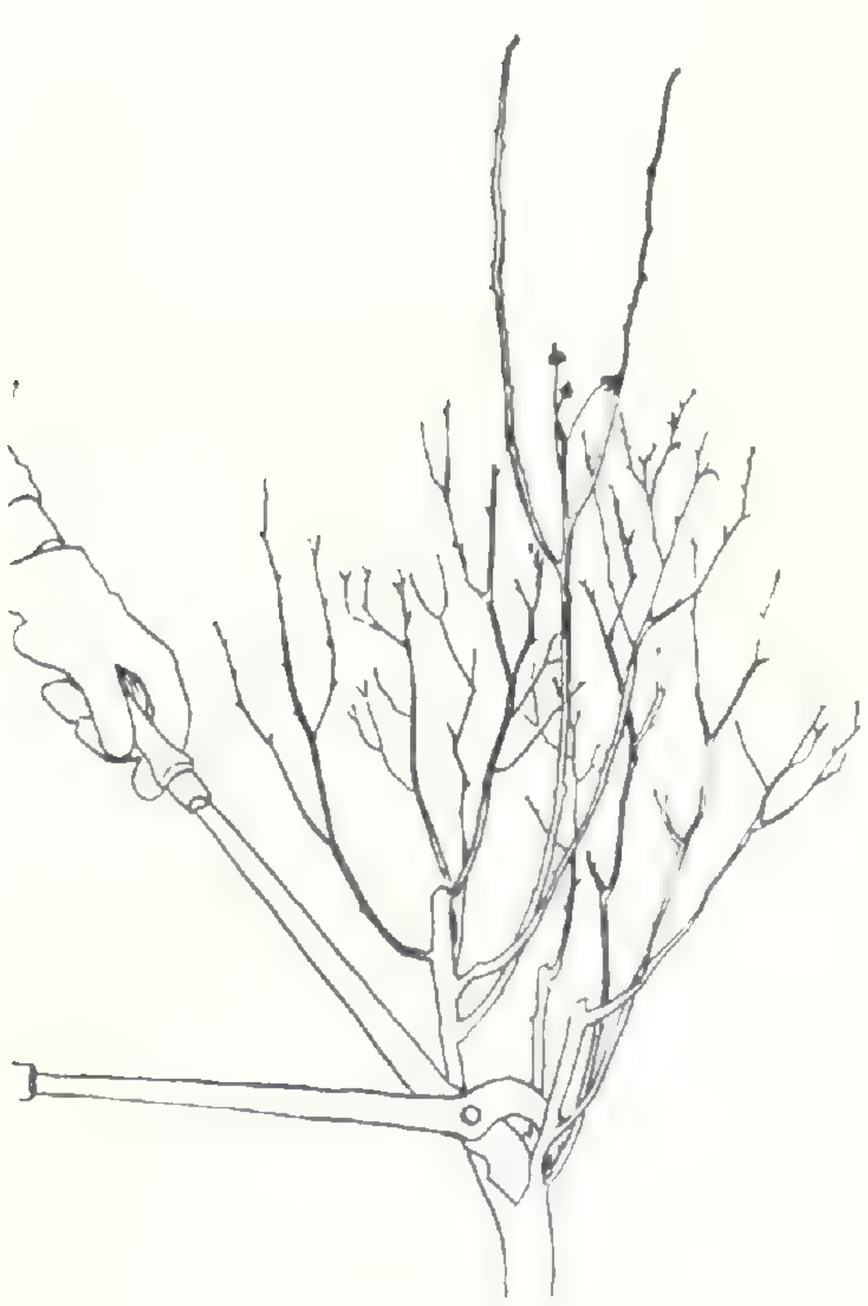

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PRUNING ROSES

1. UNPRUNED PLANT.
2. PROPER CUT WITH HAND SHEAR.
3. LOPPING SHEAR FOR LARGER CANES.
4. PRUNING COMPLETED.

short. Excelsior is fairly good; ornamental grasses, both annual and perennial, furnish good mulching material; oak leaves can be used if held in place with chicken netting; and the latest material, glass wool, is now on trial. In late November they are given a winter mulch to shield them against the wind and the sun. Polyantha, hybrid perpetual, and climbing roses pass through normal winters without the additional mulch. During unusually cold periods climbing roses may be frozen to the ground but if their roots are protected they will quickly recover and bloom the following year. Roses should not be uncovered too soon in the spring. Warm weather in February will induce the rose buds to swell, but each year such mild weather is followed by a freeze. Winter mulches are removed when the roses are pruned in late March or early April.

Spring Pruning.—All roses require some pruning each year. Polyantha roses should have the weak wood and some of the older canes removed. The remaining stems are cut back to about a foot.

Hybrid tea roses receive the most pruning. In severe winters much of the wood is frozen as far back as the mulch, but varieties differ in their hardiness. When grown for garden display they should be moderately pruned. Three to six canes are left to each plant and these are pruned to six to twelve inches, the cut being made above an outside bud. When exhibition roses are grown the plants are pruned to three eyes. Frozen wood is shriveled and brown but sound wood is green and the buds are plump. Strong-growing roses, such as the "Radiances," can be pruned to two feet. There is no particular advantage in leaving hybrid tea roses very tall, as the base of the plants becomes leggy.

Most of the new canes of the hybrid perpetuals grow from the base of the plants after the blooming period. Some of these canes grow six feet tall. At whatever height these canes are pruned in the spring, the flower-bearing laterals will develop near the top. The number of flowers of the hybrid perpetuals can be increased by tying the long canes horizontally. Most of the old flowering canes are removed during the summer.

When pruning rugosa roses examine them closely, as they frequently are infested with scale. Single rugosa roses are pruned to a height of three or four feet and the hybrid rugosas to four to

five feet. Shrub roses should always have the wood removed at the base.

Rose Varieties.—An article of this kind is not complete without a list of roses from which to choose. Soil, location and care are so variable that all the roses listed cannot be expected to grow satisfactorily in every garden. The "Proof of the Pudding," that clearing-house of rose opinion on the new varieties introduced in the last five years, which is published in each *American Rose Annual,* is an excellent guide for the rose grower who considers purchasing some of the newer roses.

HYBRID TEA ROSES

Ami Quinard—single and semi-double, velvety crimson. As reddish-black as Nigrette ever was.
Betty Uprichard—salmon-pink and coppery carmine.
Briarcliff—deep rose-pink. A sport of Columbia, and better.
Countess Vandal—coppery bronze.
Crimson Glory—rich red. A very good red rose.
Duchess of Wellington—golden-orange and salmon.
Eclipse—good yellow rose.
Edith Nellie Perkins—good pink rose.
Etoile de Hollande—velvety crimson.
Joanna Hill—white, salmon, and yellow.
Margaret McGredy—carmine-rose.
Mme. Edouard Herriot—orange-red.
Mme. Jules Bouche—white.
Mme. Leon Pain—flesh-pink.
Mrs. Charles Bell—shell-pink. One of the Radiances.
Mrs. Erskine Pembroke Thom—yellow.
Ophelia—cream-white and pink.
Radiance—pink.
Red Radiance—red.
Rex Anderson—white.

POLYANTHA ROSES

Cameo—pink to orange-salmon.
Chatillon Rose—semi-double, bright pink, large clusters.
Gruss an Aachen—mixture of pink and salmon-yellow. Large flowers. Growth variable.
Katharina Zeimet—double, pure white.
Kirsten Poulsen—tall plants, quick-growing, shrubby, suitable for hedges. Light red, single flowers.
Lafayette- semi-double, cherry-crimson.
Mevrouw Nathalie Nypels—open flowers, soft pink.
Miss Edith Cavell—semi-double, scarlet-red.
Mrs. R. M. Finch—bright rose-pink, paler towards edges. This rose is replacing Cecile Brunner as the sweetheart rose.

SNOWBANK—pure white, semi-double flowers 2½ inches across. This is one of the polyantha roses grouped under a new name, recently coined, as "floribunda roses."

CHINA ROSES

GREEN ROSE—a mass of sepals in place of petals. The best of the curiosities—black, blue, or green roses.
HERMOSA—double, soft pink. An excellent pink bedding rose.

HYBRID PERPETUAL ROSES

AMERICAN BEAUTY—pink and carmine, very fragrant.
BARON DE BONSTETTEN—velvety crimson, very fragrant.
BARONESS ROTHSCHILD—light pink, scentless.
CAPTAIN HAYWARD—deep pink, moderately fragrant.
CLIO—pale pink, fragrant.
FRAU KARL DRUSCHKI—white, scentless.
GEORG ARENDS—soft pink, fragrant.
MRS. JOHN LAING—clear pink, moderately fragrant. Continues blooming during summer and fall.
PAUL NEYRON—rose-pink, moderately fragrant.
PRINCE CAMILLE DE ROHAN—dark crimson, fragrant.

RUGOSA ROSES AND HYBRIDS

AGNES—coppery yellow, fragrant.
CONRAD FERDINAND MEYER—light pink. Pillar rose.
F. J. GROOTENDORST—small, fringed, bright-red flowers.
NOVA ZEMBLA—white, tinged pink.
PINK GROOTENDORST—sport of F. J. GROOTENDORST.
ROSA RUGOSA ALBA and R. RUGOSA ALBO-PLENA—single and double, white rugosas.
ROSA RUGOSA and R. RUGOSA RUBRO-PLENA—single and double, rosy-crimson rugosas.
SARAH VAN FLEET—semi-double, rose-pink.
VANGUARD—double, orange-salmon.

SHRUB AND SPECIES ROSES

BLANCHE MOREAU—moss rose, white, tinged pink.
CRESTED MOSS—moss rose, rose-pink.
HARISON'S YELLOW—Scotch rose—an old, hardy yellow shrub rose.
ROSA HUGONIS—single yellow shrub rose, very early.
PENELOPE—hybrid musk rose, shell-pink flowers in clusters; a shrub rose.
ROSA SETIGERA—pink flowers in clusters. A native shrub rose.

TRAILING ROSES

MAX GRAF—single pink flowers.
ROSA WICHURAIANA—creeping, glossy foliage, small white flowers.

CLIMBING ROSES

Large-Flowered Varieties:

ALIDA LOVETT—double, shell-pink.
BESS LOVETT—semi-double, crimson-red.

CHRISTINE WRIGHT—semi-double, bright pink.
CLIMBING AMERICAN BEAUTY—double, carmine.
DOUBLOONS—double, yellow.
DR. W. VAN FLEET—double, flesh-pink.
JACOTTE—semi-double, apricot. Somewhat tender.
MARY LOVETT—semi-double, white.
MARY WALLACE—semi-double, bright pink.
MRS. ARTHUR CURTISS JAMES (Golden Climber)—semi-double, yellow. Plant in full sun and prune lightly.
PAUL'S SCARLET CLIMBER—semi-double, intensely red.
PURITY—semi-double, white.
ROSERIE—double, frilled, deep to light pink, thornless.
SILVER MOON—semi-double, white.
ZEPHIRINE DROUHIN—semi-double, rose-pink, thornless.

Small-Flowered Varieties:

AMERICAN PILLAR—single, scarlet with white center.
DOROTHY PERKINS—double, pink.
EVANGELINE—single, soft pink.
EXCELSA—double, deep rose-pink.
GHISLAINE DE FELIGONDE—semi-double, apricot-yellow.
GRUSS AN FREUNDORF—semi-double, dark crimson.
HIAWATHA—single, carmine with white center.
WARTBURG—semi-double, deep pink.
WHITE DOROTHY—same as DOROTHY PERKINS except color.
WICHMOSS—moss-covered buds, semi-double, bright pink.

CONCLUSION

This article has been written for the express purpose of answering the many fundamental questions on rose culture in St. Louis and vicinity. It is felt that by following the simple cultural requirements as to drainage, good soil, food and water, and selecting standard varieties, together with the novelties, the rose grower will be rewarded for his efforts. Rose plants do require more attention than some other plants, but it must be remembered that the bush roses bloom in the spring, furnish some flowers during the summer, and a second major crop in the autumn. The amount of care that roses require during the year is not so great as to deter any one from growing them. In a discussion of this kind excursions could be made into the history of the rose; a presentation of the 1939 rose introductions; hybridization; budding and other interesting rose subjects. No attempt has been made to enumerate all of the insects and diseases that could occur lest the rose novice gain the impression that having a rose garden is a matter of battling the enemies rather than cutting and enjoying a bowl of roses. If the plants are dusted or sprayed as suggested, with due empha-

sis on regularity, the plants should remain free from any troublesome pests. All of the varieties mentioned have been grown here at the Garden, and of the eighty-four listed in the different classes, seventy-six of them are in the present collection. P. A. K.

(Drawings by P. A. K. and Robert B. Clark)

STATISTICAL INFORMATION FOR JANUARY, 1939

GARDEN ATTENDANCE:

Total number of visitors	12,330

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	25
Total number of books and pamphlets donated	68

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	10

HERBARIUM ACCESSIONS:

By Purchase—

Degener, Otto—Plants of Hawaii and Borneo	82
Heller, A. A.—Plants of California	350
Kay's Photo & Optical Company—Photographs of type specimens	5
Williams, L. O.—Mexican orchids	125

By Gift—

Anderson, Edgar—Photographs and illustrations of *Aquilegia*	9
Anderson, Edgar—Plants of Mississippi, Louisiana, and Arkansas	42
Hale, Edna Kate—Plants of Arkansas	36
Herbarium of Oakes Ames—Herbarium specimens and photographs of orchids	5
New York Botanical Garden—Plants of British Guiana	2
Russe, Fred, Jr.—Plants of Louisiana and Arkansas	12
Stokes, James R.—Ferns of Georgia	49
U. S. Department of Agriculture, Washington, D. C.—*Rauwolfia tetraphylla* L. from Laona Island, West Indies	1

By Exchange—

Barkley, Fred A.—Photostats of herbarium specimens	8
Chrysler, M. A.—Ferns of Jamaica	51
Garrett, A. O.—Plants of Utah	51
Hermann, F. J.—Plants of Michigan	51
Hesler, L. R.—Plants of Tennessee, etc.	125

By Transfer—

Pring, George H.—*Dendrobium taurinum* Lindl. from the Philippine Islands	1
Total	1,005

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Missouri Botanical Garden Bulletin

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

THE CHINELA

Phragmopedilum caudatum var. *Warscewiczii*

Missouri Botanical Garden Bulletin

Vol. XXVII MARCH, 1939 No. 3

SOME EXPERIENCES OF AN ORCHID COLLECTOR

I. REDISCOVERING THE RARE "CHINELA"

One of the rarest and most interesting of Central American orchids is the almost fabulous "Chinela," *Pragmopedilum caudatum* var. *Warscewiczii*. Although the original type of the species was discovered in Peru by the Spanish botanists, Ruiz and Pavon, as early as 1778-89, it remained for the great Polish explorer, von Warscewicz, to find by far the finest form on the slopes of the Volcano of Chiriqui, in what is now the Republic of Panama. This orchid is in every way a most remarkable plant, and has undoubtedly created a greater sensation in the greenhouses of Europe than any other member of its genus. It is unique in opening all of its flowers together, and they, in an undefinable way, manage to combine the beautiful with the almost unbelievably grotesque. Upon first opening, the petals are about four inches in length, but they rapidly elongate at the rate of about two inches a day until the remarkable total of thirty inches is sometimes reached.

As was to be expected for so striking a plant, the Chinela was ruthlessly collected both in South America and on the Volcan de Chiriqui, until it has become practically extinct in many of the regions where it formerly flourished. Unforunately, the natural conditions to which it is accustomed are very hard to duplicate in the greenhouse, and almost all plants in cultivation have long since disappeared.

When, during the summer of 1938, the proposal came for a botanical survey of the Volcan de Chiriqui, territory covered by

von Warscewicz, naturally we were in hopes of finding traces of the Chinela. Once actually on the ground, however, our host, Mr. T. B. Monniche, held little hope of our finding it. Much of our collecting would be on lands owned by him, or those closely adjacent, with both of which he was intimately familiar from his studies of birds. The last plants seen by him were those collected by Mr. G. H. Pring, of the Missouri Botanical Garden, some ten years previously. This collection came from an isolated valley quite a distance from Mr. Monniche's estate, and he believed that none further had been found.

In the course of the conversation, Mr. Monniche mentioned that he had made arrangements for the priest of Dolega to hold mass for the benefit of the peones working on the grounds. It would be the first time that mass had been said in that isolated region, and he asked if we would like to come down from our collecting camp at 7500 feet to photograph the ceremony and the local people. Very fortunately for us, as we came down the long winding trail, we found the local peones made brave in store clothes, stiff in unaccustomed shoes, and with a festive air bringing flowers to decorate the bamboo chapel.

As services began, with the padre intoning the mass, an old wizened woman came hurrying through the coffee bushes, carrying more flowers. To our utter astonishment, among a general collection of lilies and larkspurs were three cut spikes of the long-lost Chinela. Hurriedly thrusting the flowers into the wall of foliage surrounding the rustic chapel, she reverently knelt while the mass continued. As may be supposed, we had difficulty in preserving suitable decorum while the padre told off the ten commandments, the cardinal sins, and sang the "Purissima," all in a rolling Old-World, Barcelona Spanish. Finally, with Mrs. Monniche standing sponsor for our good intentions, we learned that our good woman was the wife of one Sr. Garsong, and that she lived far away in a little fog-ridden valley near the great Cerro Horqueta. She was not returning that day, she told us, but three days later her nephew could guide one of us to her home. Between shyness and evident trouble with one lone snag tooth, she lamented that she had formerly had eight plants of the Chinela growing on a fallen log, but that the horses *had eaten six* of them the week previously!

With excited minds we returned to our camp, to roll and toss on our bracken beds and between scratching flea bites to dream of monster orchids with petals stretching the entire six miles from the Monniche's home to our camp.

Finally there came an unpropitious dawn, with our little clearing drowned in wet fog. Our two native boys looked out on a dismal world, shuddered, and wrapped themselves tighter in their ponchoes. The firewood was wet, and above all, there was no water. The following conversation may be taken as typical:

"Nicho, do you think you can go down to the spring and get some water?"

Nicho very sleepily answers, *"Como?"* [What?]—upon which the question is repeated.

Then the old aggravating reply, *"Quien sabe?"* [Who knows?] which means nothing or anything, but certainly no action.

By the time I had personally fetched the water from the spring, and found the boys still in a somnambulant state, righteous anger came to the fore, and seizing my collecting case I left them to their fate and cut out across country looking for specimens.

The trail dropped down through a dense growth of giant bamboo, turning into wet ravines dotted with the enormous-leaved tree Piper (new species and largest of the Pipers) which we were collecting for the second time, our first specimens having been lost in the fire. Soon the weather cleared, and on reaching about 6500 feet, we found a hardier growth of oak, alder, dogwood, and magnolia. The magnolias here are stately things, probably the largest in the world, with sheer trunks towering fully one hundred feet. The showy white blooms are best seen across the jungle ravines, where the eye is on a level with the tree-tops.

In dropping over into such a ravine, a tiny settlement was spied where a noisy brawling brook emptied into the busy little Rio Caldera. At one of the first houses I met an old woman setting fresh tortillas out to cool. Thinking these would prove a welcome stay to an empty stomach, I stopped to buy a few, at the same time asking if she had heard of the Chinela for which we were looking. "Of course, I have one myself," said she, proceeding to show me a beautiful healthy plant growing on a stump near the house. It was carrying a fine flower spike, and my mouth fairly watered

with envy. After considerable harangue, she finally consented to part with her treasure, adding that a near neighbor had several more. It was beginning to look as though they were everywhere.

At the neighbor's house only two girls were found to be at home. When they replied in the affirmative to queries as to whether their mother had attended the "Missa" on the previous day, I rather naturally supposed that I had stumbled accidentally on the home of our ancient friend. After the purchase of the three plants had

THE CHINELA

A MAGNIFICENT SPECIMEN OF ONE OF THE RAREST ORCHIDS COLLECTED

been virtually completed, the mother suddenly appeared upon the scene, and lo and behold, it was not our friend but a total stranger! It developed that she was the famous "Delia," from whom Mr. Pring had purchased his plants over ten years before. She remembered him perfectly and said that she had gathered the plants shortly after his visit in the hope that he would return for them. Nearly all the other plants scattered about the valley had been gifts from her original stock, she told me, and she had not seen a plant growing naturally for years.

After further inquiries, a gnome-like villager presented himself, volunteering for the task of guiding me to the last (and original) find of our prize. We trailed down the roaring Caldera, passing under high sheer rock faces where the river tumbled madly in its narrowed bed. Crossings were made where necessary on jams of giant logs, or on crude suspension bridges rigged from jungle vines. The old woman's home was finally reached, and the remaining two plants fished out of the top of an orange tree, where they had been put in safe-keeping against the ravages of the horses.

Our total take of six plants was carefully packed in a wicker basket with mats of moss placed in such a way that the two flower spikes could be carried without injury. We were rewarded for our pains on our return to the Tropical Station with the sight of two perfect specimens of one of the world's rarest blooms. The plants were packed with the utmost care and sent by air-mail to St. Louis where they now form part of the Missouri Botanical Garden collection.

II. COLLECTING IN DARIEN

Of the entire republic of Panama, the vast province of Darien, lying on the border of Colombia, probably offers the richest field for plant collecting. Since the population is small and concentrated along the rivers there is a lack of inland trails and travel becomes painfully slow and difficult. Undoubtedly explorations carried into the vast lowlands and especially into the higher mountain regions will result in a wealth of new finds of commercial, scientific, and ornamental value.

The Tropical Station is ideally situated as a working base for collecting in this region. During the last trip into the province several new species of horticultural value were discovered, principal of which were a new Crinum and the giant Aristolochia |September, 1937, BULLETIN|. Unfortunately, the specimens of Aristolochia were lost during the disastrous fire of 1937, rendering their definite identification impossible. Since this plant often carries flowers as much as seven feet long, more than twice the length of those of any known species, it will probably take its place as having the largest flowers of any plant in the New World.

With the hope of obtaining fresh specimens of the giant Aristolochia, as well as seed for distribution, a trip into Darien was

made during October, 1938. Passage was engaged on one of the tramp banana boats running down the coast, the trip being made with little incident. Our ship passed very close to the Island of Pacheca, of the Perlas group. Apparently there are hundreds of these islands, almost entirely uninhabited. None of them rise to any great elevation, and all are covered with a shrubby cactus. Rocky headlands alternate with shining sand beaches, the gaps between islands often being less than a quarter of a mile. The waters abound in tuna, a fine one being caught over the stern by one of the crew. Thousands of man-of-war birds wheeled in the sky, while pelicans sailed close to the water in graceful V's, broken occasionally by tremendous splashes as one would dive for fish.

Entrance was made into the Bay of San Miguel near Garachine Point, as our captain had orders to avoid crossing the reef after the wreck of the old ship "Baru" there a year before. Fine weather we had throughout, the squalls following the coast and shrouding the higher peaks in driving rain. After all passengers had declared their business and been OK'd by the Panamanian officials in La Palma, we continued past the town of Chepigana, towering white clouds setting off the low mangrove-filled shore. El Real was reached at about 10:00 p. m., and the balance of the night was spent on board, anchored in the river.

In the morning, Mr. Beardsley, the agent for the banana company, took time from superintending the wildly gesticulating crowd bringing bananas to the ship, to provide me with a long *piragua* equipped with an outboard motor to carry me to the town of Yape. He also kindly gave me an introduction to the new manager of the banana company's farm where I would be furnished lodging and working room. I was relieved to learn that the former manager of the finca, whom I had last seen suffering from beriberi, had had an unbelievable stroke of good fortune. He had won seven hundred dollars in the National Lottery which had enabled him to buy a small farm in the highlands of Chiriqui.

The night was spent in the familiar open corrugated iron shack, among the bananas. In the morning I made the mistake of calling the manager's attention to the empty water barrel and speculating as to the possibility of rain. To my horror, I learned later that in my absence he had one of the boys fill the barrel to the brim with

river water, very effectively contaminating it beyond any hope of fresh water. It might be well to explain that in addition to all natural filth, of which there is an abundance, the river serves as a common sewer for all the villages strung along its banks. Since dysentery is very prevalent, the contamination of the one source of fresh water constituted a problem.

Search was begun that morning for the Aristolochia, but it was soon found that the river, through repeated floods, had long since obliterated all sign of the original collecting grounds. Finally, after all attempts on land seemed more than futile, I secured a small *piragua,* and nosed it in and out the river banks above the village. The Aristolochia vines have an annoying habit of choosing the thorniest and brushiest sort of trees to climb. We soon were finding plants but absolutely no signs of flowers. Finally we discovered that the best system was to crawl on all fours, under heavy liana-laden bushes, on a narrow mud ledge along the river bank, and to peer up into the tangled foliage for signs of blooms. After only about an hour of this exhilarating sport, we were rewarded with one half-developed bud, with the caudal appendage wrapped in a hopeless tangle among the neighboring lianas. Very carefully we cut away all obstructions and finally extracted our prize entire. It was found to measure five feet six inches in length, and probably would not have opened for another two weeks. Search as we would, we were unable to find any sign of seed and had to be satisfied with cuttings.

On the following day, since the river seemed to be fairly worked out for specimens near Yape, I engaged a boy to pole me up the river to Boca de Cupe, collecting along the way. On one of our stops my guide directed me to the house of one of the Cholos, who, he said, was a great "*curandero,*" or medicine man. The house was a typical one, set on hard palm poles, thatched, and with the usual notched log for stairway. It contained about five adults and several children. The *curandero,* a man of about sixty, seemed to be the grandfather. He spoke excellent Spanish, only resorting to the clicking guttural Choco to keep order among the curious children. He seemed quite intelligent and described many uses for the plants that had been collected in the course of the day. One very common Composite was described by him as a fish poison for

use in still pools. Many of the plants, he admitted, were of no known use, which was rather unusual, since the common practice is to ascribe marvelous cures to the most common weeds, for the edification of the strange Gringo. One of his daughters was suffering from a severe headache, which they said had continued for many days and responded to no treatment. The old man knew of aspirin, and asked if I had any. Since I fortunately did, we left fast friends. He seemed interested in my camera, but would not agree to photographs, seeming to fear some sort of evil eye.

Most of the Indians along the river had their bodies almost entirely covered with black paint, some having designs in red on the face. They seemingly never wash, and the designs become hopelessly smeared after a few days (or weeks). Since the rice harvest was in, being in evidence on all sides in long bundles drying in the sun and in immense shocks within the house, all the people were in high spirits. My guide said that the paint was in celebration of a harvest dance held at the first cutting of the rice. At nearly every bend of the river the Cholo women would be seen thrashing out the rice from the chaff, tirelessly turning the rice with the left hand while the right wielded the heavy cocobolo pestle, carved somewhat in the form of a tall hour-glass.

The Rio Tuyra becomes very winding above Yape. On the banks the usual patches of high white-trunked forest alternate with bananas planted in the rich alluvial land. Evidently the river changes its course constantly, carving huge slices from a prosperous farm to build up an evil-smelling mud flat, rank with wild cane, on the farther shore. As formerly, trails were found to be too dark for good collecting, so that most of our efforts were confined to the river banks. Low gnarled trees of a species of Inga, called "*azote caballo,*" leaned at intervals over the stream, their blooms imparting a delightful fragrance suggestive of fields of clover.

Boca de Cupe was found to be a sizeable village of perhaps sixty houses, populated chiefly by Colombian negroes. I had been told that the Rio Tuyra here began its series of rapids approaching the Colombian line, but I found it entirely undiminished in size, with the same boiling muddy current. It is evidently a larger and longer river than has been supposed, and probably has its headwaters somewhere in Colombia. The return was made with

little incident, one stop being made to barter for rice and woven baskets at a Cholo home.

After working up my collections and seeing them safely bundled against damage from rain or chance wetting in fast water, I engaged a boy to take me down the river on the following day to El Real, where I hoped to catch a boat for the Zone. He arrived with a fine twenty-foot *piragua*, in which we swept down the river past majestic stands of white Cuipo trees. A considerable amount of material was collected around Pinogana. Upon our arrival in El Real, about dark, no sign of a boat presented itself, so that temporary quarters were again taken up in a shed. It was an open, iron-roofed affair, and housed a rice mill of German manufacture which had evidently been out of order for some time. On the following day a strapping Colombian damsel moved in with a huge wooden mortar, proceeding in the age-old way to thrash rice and showering my mosquito bar and collecting material with chaff.

Fortunately the vicinity of El Real also proved to be quite rich in material, so that the two days' wait for the boat was well occupied. The principal problem soon became that of keeping the specimens already collected from molding.

On the afternoon of the second day, the banana boat "Darien" appeared, only to leave immediately for Yaviza, on the Rio Chucunaque, to load plantains. It returned the following morning, however, on my urgent request, and we sailed immediately down the river. The "Darien" developed to be an old wooden hulk, built along very trim lines, in which there had recently been installed a powerful Diesel engine. When under way the old crate trembled from stem to stern, looking for all the world like a panting horse. Although we made excellent time when running, I was in constant fear that our craft would fall into its component parts, like the "One Hoss Shay," and leave us swimming. After innumerable delays, loading plantains, mahogany, bananas, passengers, or merely anchoring to pass the time of day with another boat, we finally reached La Palma. From there, we ran far up the Rio Savanna and met a huge raft of mahogany beams manned by two of the wildest specimens of humanity that I have ever seen. With considerable difficulty the raft was dismembered and hauled aboard. Finally we pointed our head downstream, toward Balboa.

We arrived in Panama City just thirty-six hours after leaving El Real and spent the next four days frantically drying specimens over electric stoves at the Station. Some five hundred sheets in all were secured, containing a good percentage of the large timber trees then in flower. All these have been sent to St. Louis for critical study.

III. TREE FERNS

One of the most interesting features of a tropical flora is the existence of certain primitive types long since vanished from the face of the earth in more rigorous northern climes. Among the most remarkable of these are the tree ferns, which grew luxuriantly on the continental United States in late Paleozoic times and contributed to the building of the vast coal deposits. Although driven farther and farther toward the equator by successive climatic changes, they still flourish in the rainy tropics of both the Old and New Worlds. They are probably some of the world's most stately plants, waving their enormous lacy fronds atop trunks sometimes reaching a height of thirty feet.

Tree ferns have long been grown in tropical botanic gardens throughout the world, being planted along streams, beside pools, and in luxuriant groves against more sombre foliage. It had been our wish for some time to establish a few of the Panamanian species on the grounds of the Tropical Station. We had been told that they were practically impossible to transplant from the wild. Our first attempts tended to prove this statement true, since two lots of a dozen plants each brought in to the Station died immediately. These were moved during the dry season, and although water had been copiously supplied at the roots, it was to no avail. We suspected that the difficulty might be the lack of humidity in the air and decided that the third attempt would take place at the beginning of the heavy rains in May of the present year. We brought in four plants with trunks varying in height from four to ten feet. All of the fronds were removed, and generous balls of earth were left about the roots. To our delight all of the plants began sending out new fronds at once and have grown without any check since.

The next experiment was to see if it were necessary to plant the ferns in deep shade. Since we were troubled with a weedy tree

which dropped leaves into our pool, we decided to replace our eyesore with a specimen tree fern which we had admired for some time in the mountainous region leading into El Valle, in Cocle Province. With abundant profanity and the help of four local Indians we managed very painfully to snake the giant twenty-foot trunk out of the little canyon in which it grew. It was necessary to send a man ahead with a machete, to cut back all trees and shrubbery far enough to allow the men to pass. The floor of the canyon was boulder-strewn, so that the sizeable ball of earth had to be carefully lifted over and around many obstacles. When the half-mile to the truck had been covered, not a man of us had any skin left on his shoulders. We estimate that the trunk and ball weighed about 600 pounds. With the ball of earth resting on the tail gate of the truck, the top incurled fronds reached fully seven feet over the entire length of the truck.

With little further trouble, the specimen was planted at the corner of our lily pool, in full sunlight. It is at present unfolding its second set of fronds, and is one of the most prominent features to meet the visitor's eye at the entrance to the Station grounds. All in all, fifteen tree ferns have now been established, adding greatly to the Station's appearance.

IV. CATTLEYA DECKERI

So much have the various species and hybrids of the genus Cattleya been used in commercial floral work that the average person thinks of them as *the* orchid and must be persuaded that such genera as Dendrobium, Stanhopea, and Sobralia are orchids also. Generally he is disappointed if shown anything except Cattleyas. In providing these for show purposes, the Tropical Station is presented with somewhat of a problem. While the orchid grower in the North has simply to adjust the temperatures of his greenhouses to the particular needs of his plants, in Panama, with outdoor climatic conditions fixed, it becomes necessary to select plants suited for that climate. Unfortunately, the majority of the Cattleyas follow the high mountain chains from southern Mexico into Peru and Brazil. Most of them come from 4000 to 6000 feet elevation, needing a cool, moist climate. When such plants are brought to the Tropical Station at sea level, with its

uniformly warm temperatures, many soon die and others grow well but develop a non-flowering habit.

Fortunately there are several Cattleyas which flourish under exactly the conditions which nature provides in the lowlands of the Canal Zone. One of these is *Cattleya Deckeri,* native to the Republic of Panama, whose rose-purple flowers bloom profusely during the months of September and October.

Since *Cattleya Deckeri* provides one of the principal showings of flowers at the Tropical Station, it was recently decided to increase our already large collection of these plants. Although found throughout the Republic growing high in the branches of several species of trees, the best collecting grounds are in areas of huge boulders, where the plants attach themselves in great mats to the rock faces.

The area selected for the recent collection is a section of low, rocky hills thrust out from the main range of the cordillera some forty miles west of the Canal Zone. The road leading into this region skirts the mangrove-filled coastal flats, crossing areas of the typical "llano" or grasslands alternating with patches of thick, thorny, scrub trees. On the rocky hillsides, stands of *Plumeria acutifolia* are conspicuous, often taking hold in the tiniest cracks of the bare rock. After climbing through thin woods, filled with shoulder-high grass, we found an abundance of plants distributed on the eastward slopes of the boulders. They were growing in every type of situation, on low scrubby trees, on the tops of the rocks in accumulations of trash and leaves, and on the bare stones exposed to the full force of the morning sun.

Several hours were spent clambering over the rocks, digging the plants, and carrying them entire to central piles. After enough had been gathered, the clumps were trimmed of all dead or unnecessary material to lighten our loads when packing them out to the road. They were then carefully stowed in wicker pack baskets, so as to minimize breakage of the leathery leaves. Since some of the plants were soon to start on their long journey to the East Indies for exchange, we were anxious that they be in as good condition as possible.

Each of us loaded one of the packs, weighing about fifty pounds, on our backs, and took a short cut down the face of the bluff. After

zigzagging down several narrow rock shelves and chopping clear some of the thorny underbrush, we managed to clear a trail into the more open forest. To bring out our entire collection, seven trips up the bluff and down were required. The last five loads were brought out in a driving downpour of rain which made our narrow trail dangerously slippery.

On our return to the Tropical Station, we found that we had collected about three hundred plants. They have all been planted in large specimen pots or baskets, with from three to fifteen leaves, and should be a fine addition to our showing next year.

P. H. A.

NOTES

Mr. George H. Pring, Superintendent of the Garden, acted as a special civil-service examiner for the Chicago Parks, February 8.

Dr. David C. Fairburn, Horticulturist to the Garden, spoke before the Delta Gamma Mothers' Club, February 8, on "House Plants."

An illustrated lecture on "Panama" was given at the meeting of the St. Louis Horticultural Society, February 3, by Dr. Robert E. Woodson, Jr., Assistant Curator of the Herbarium.

Mr. A. P. Beilmann, Arboriculturist to the Garden, gave an illustrated talk before the Good Earth Garden Club of Kirkwood, February 20, on "Some Diseases of Shade Trees."

Mr. W. L. Brown, Graduate Student at the Garden, gave a talk to the Greater St. Louis Association of Gardeners, at their meeting, February 7, on "Lawn Problems of the Middle West."

Science Service (January 13, 1939) has printed an abstract of the article "What Shall We Do with the Christmas Poinsettia?" from the December, 1938, BULLETIN.

For at least two winters, during February, a small flock of ducks has been seen on the lake at the Garden Arboretum. Recently they were identified as the ring-necked duck, one of the scaup ducks.

The February number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN (Vol. 26, No. 1) has been issued, consisting of a

paper by Hereford Garland, on "A Microscopic Study of Coniferous Wood in Relation to Its Strength Properties."

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, gave an illustrated lecture "Searching for Botanical Treasures in Texan Deserts," before the St. Louis Florist Club, January 12; and on "Gardens of Virginia and Texas," before Group 8 of the Webster Groves Garden Club, February 3.

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, has an article in the February issue of *Gardeners' Chronicle of America* (**43**:53-54) on "The Misunderstood Kalanchoids," which was later reprinted in part in the February 17 number of *Southern Florist and Nurseryman* (**46**:16-17). Mr. Cutak's "Report of a Plant Hunt in Texas" from the December, 1938, BULLETIN, was reprinted in the January 6 number of *Southern Florist and Nurseryman* (**46**:3-4, 18-19).

Mr. Paul A. Kohl, Floriculturist to the Garden, gave a talk to the Business Girls' League of the Y. W. C. A., February 21, on "A Tour Through The Missouri Botanical Garden." On March 7 he spoke before the Triangle Alumni Association of St. Louis on "The Missouri Botanical Garden."

Dr. Carroll W. Dodge, Mycologist to the Garden, attended the council meetings of the American Association for the Advancement of Science, at Richmond, Va., December 27-30, representing the Mycological Society of America and The Academy of Science of St. Louis, and he presided at the meetings of the American Microscopical Society.

Mr. George H. Pring, Superintendent of the Garden, has given the following talks recently: January 5, before the Men's Club of the Shaw Avenue Methodist Church, on "The Romance of the Plant World"; at Chicago, February 6, before the Chicago Association of Gardeners, on "The Breeding of Tropical Water-lilies," and February 9, before the Chicago Men's Garden Club, on "Development of the Russell Lupines"; March 13, over Station KXOK, and March 16 and March 21, over Station KSD, on "The Greater St. Louis Flower and Garden Show."

Recent visitors to the Garden include the following: a party of superintendents of Texas public schools, Mr. C. M. Selman, of

Brenham, Mr. W. C. Perkins, of Shamrock, and Mr. Allen Kavanaugh, of Wheeler County; Mr. Art. Smith, Horticulturist, of Boone, Iowa; Mr. J. M. Batchelor, of the U. S. Soil Conservation Service, Washington, D. C.; Mr. H. A. Stevenson, of the U. S. Soil Conservation Service, Elsberry, Mo.; Mrs. J. J. Taubenhaus, in Charge of the Herbarium, Texas Agricultural Experiment Station, College Station; Miss Mary Gentry, Graduate Student, University of Wyoming, Laramie; Dr. Delbert Swartz, Associate Professor of Botany, University of Arkansas, Fayetteville; Dr. E. E. Naylor, Assistant Professor of Botany, and Mr. J. T. Middleton, Graduate Assistant in Botany, University of Missouri, Columbia; Dr. F. A. Varrelman, Professor of Botany, De Paul University, Chicago; Mr. F. L. Kellogg, of the Central States Forest Experiment Station, Columbus, Ohio; Mr. M. Truman Fossum, student in Horticulture, Cornell University, Ithaca, N. Y.

STATISTICAL INFORMATION FOR FEBRUARY, 1939

GARDEN ATTENDANCE:

Total number of visitors	29,226

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	27
Total number of books and pamphlets donated	141

HERBARIUM ACCESSIONS:

By Purchase—

Degener, Otto—Plants of the Philippine Islands, collected by Topping	286
Magnusson, A. H.—"Lichenes selecti scandinavici exsiccati," Fasc. XII & XIII, Nos. 276-325 incl.	50
Stephani, Johanna—Stephani, "Icones Hepaticarum"—Copies of sketches	250

By Gift—

Anderson, E.—*Pinus Thunbergii* Parl. from horticulture	1
Andrews, H. N., Jr.—Ferns of Florida	15
Becker, Gilbert, by E. Anderson—*Tradescantia bracteata* Small from Michigan	1
Brigham Young University—Plants of Utah	40
Clokey, I. W.—Plants of Nevada	39
Grant, Theodore J.—Plants of Virginia and Pennsylvania	2
Lundell, C. L., by R. E. Woodson, Jr.—Apocynaceae from Mexico	10
McFarland, Frank T.—*Senecio Petasitis* DC. from horticulture	1
Smith, A. C. by R. E. Woodson, Jr. -Plants of British Guiana	3

By Exchange—	
Botanical Garden and Museum, Berlin-Dahlem—Photograph of *Cyclobothra purpurea* Sweet from Mexico	1
Botanical Museum of Harvard University by L. O. Williams—Philippine orchids	56
Cornell University by K. M. Wiegand—Plants of New York	104
By Transfer—	
Ownbey, Marion—Plants of horticulture	6
Total	865

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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Director

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Pathologist

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REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.,
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXVII APRIL, 1939 No. 4

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

BULL-HEADED DENDROBIUM
Dendrobium taurinum

Missouri Botanical Garden Bulletin

Vol. XXVII APRIL, 1939 No. 4

BULL-HEADED DENDROBIUM

(Dendrobium taurinum Lindley)

Despite its rarity in present-day collections, *Dendrobium taurinum* has been known for nearly a century. About 1840 it was discovered and collected in the Philippines by Cuming, who sent it to the establishment of Loddiges, in England. The plant flowered there for the first time in 1842, and was described and illustrated by Lindley in Edwards' "Botanical Register" in 1843, pl. 28. The following brief description, with subsequent remarks, suggests the obvious difficulties in formulating taxonomic characters to fit the early introduced species:

"Whether or not it is possible to divide the great, and unnatural genus Dendrobium by any really stable characters is uncertain. It certainly appears to contain several distinct types of structure, but up to the present time I have sought in vain for anything sufficiently precise on which to found generic characters.

"Among the sections of the genus no one is better marked than this, which consists of species with a stiff erect habit, racemes of flowers placed on a long peduncle opposite the leaves, large showy flowers, and the petals remarkably longer than the sepals. But beyond this I can find nothing that differs from Dendrobium; and as the three first characters are merely of habit, the last can hardly be regarded of enough importance to authorize the establishment of a genus. For this reason I proposed in the *London Journal of Botany* to combine them, under the name of *Dendrobium spatulata*, into a new section of the genus."

The Garden's plant was received in 1922 in a collection from the Philippine Islands sent by the Governor-General, Dwight F.

Davis. It is now fully grown, 5 feet high, with stiff cane-like pseudo-bulbs swollen at the base. Along the upper two-thirds of the pseudo-bulbs are 27 ovate-oblong, amplexicaul leaves, the lower ones 3 inches long, 2½ inches wide, decreasing in size toward the apex.

From the top of the new growth is a graceful horizontal flower-spike, bearing 19 pendant cream-colored flowers. The sepals are triangular, cream-colored, 1 inch long, ¼ inch wide, entirely covering the spur at the back. There are 3 petals, rolled back, twisted toward the ends. The labellum is 3-lobed, hinged at the base of the spur, with 3 prominent elevated lines in the middle, ruffled at the margins, white flushed with pale green. The exposed column is white tinged with purple at the base where it joins the petals; anther caps yellow.

The lip, column, and twisted petals together resemble the figure of a bull's head, and suggested the specific name. Except for the pseudo-bulbs, the plant could be easily mistaken for an Angraecum.

G. H. P.

ONE-WAY TREES

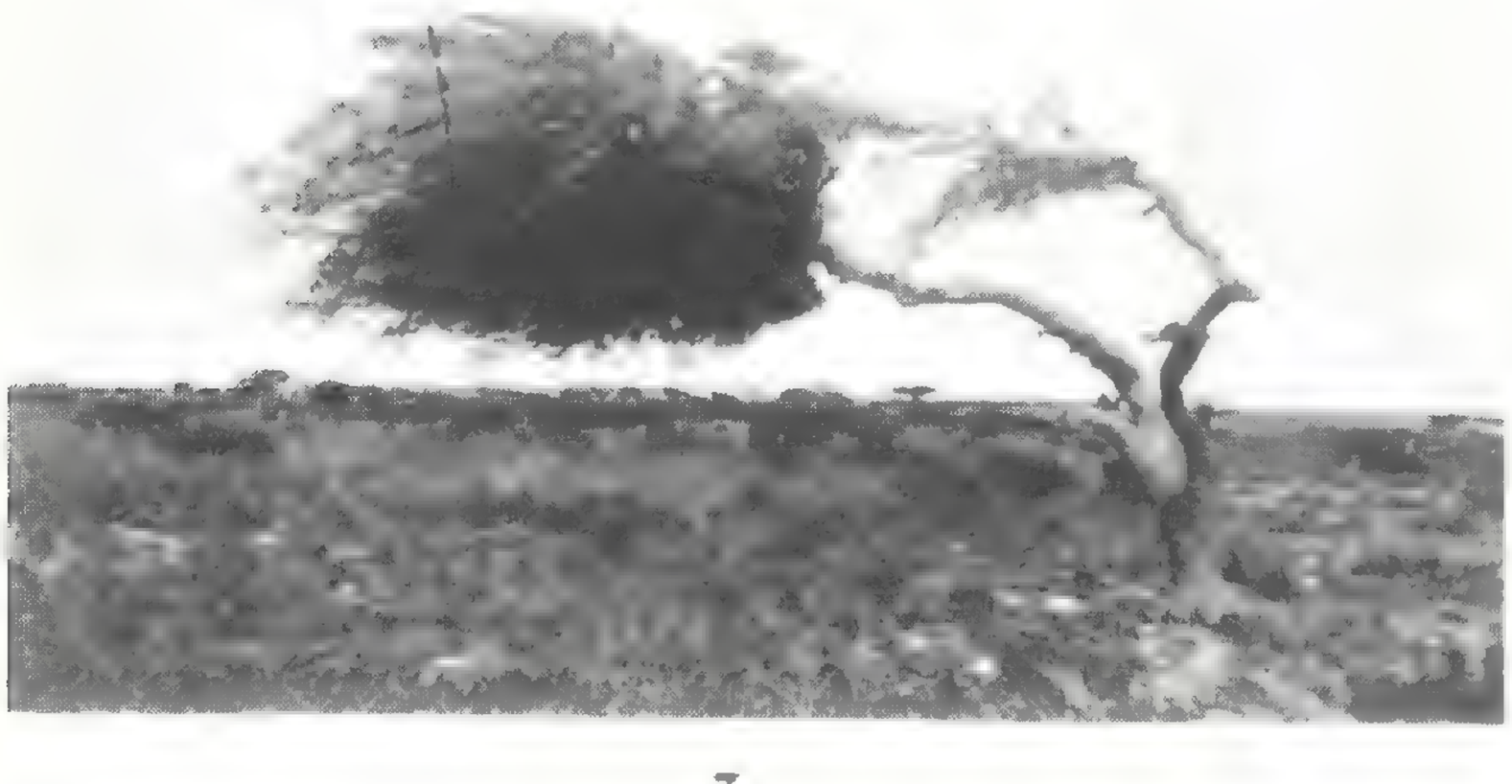
The effects of strong winds and generally adverse climatic conditions on plant life are often weird and striking. Wind-blown pines, spruces, and the like are quite common both at sea-level where trees are exposed to strong winds, and also in the vicinity of timber-line on our higher mountains, but these are seldom as pronounced as those described here from Aruba.

Aruba is a fair-sized island (some 20 miles long and 5 miles wide) lying off the coast of Venezuela, near Curaçao. Its position is directly in the path of strong easterly trade winds, which accounts for its peculiar "one-way trees." Some idea of their size may be gained from comparison with the telephone pole in fig. 1; likewise the force of the wind is well illustrated by the bent trunk of the tree in fig. 2. As shade trees these are almost total failures, and it certainly would be rather a feat to sit in their shade.

Henry Andrews.
Photographs by Don Heebner.

1

2



3

ONE WAY TREES

ONE REASON FOR THE HIGH COST OF ORCHIDS

"I read with pleasure and interest Mr. Stables' account of sales held by the famous firm of Horticultural Auctioneers in the early years of this century *(The Orchid Review,* October, 1937).

"The late Mr. H. T. Pitt purchased *O. c.* var. *Pittianum,* with three other Odontoglossums, for 600 gns. [$3,000.00], the former plant being valued in this deal at 300 gns. [$1,500.00]; the other three were of comparatively small value. They were purchased from the late Mr. Thomas Rochford, who had commissioned the late Mr. John Carder to collect twenty-five thousand Odontoglossums, and all these were then known as the true Pacho or Carderian type of *Odontoglossum crispum.*

"At that period we had the pleasure of cultivating all the choice Odontoglossums belonging to the Rosslyn collection, and Mr. Pitt brought those four plants down to Cooksbridge personally; he felt he had paid a very long price for them, in fact he told me what he had paid, but charged me to hold fast the secret of their cost, lest other *Odontoglossum* admirers should think him slightly unbalanced! It must be remembered that 300 gns. was a record price for any *Odontoglossum* up to that period.

"If my memory is correct, the late Baron Sir John Henry Schröder, Bart., purchased *O. c.* var. *Apiatum* at Messrs. Stevens' sale rooms at 160 gns. [$800.00], and thus began the period of soaring prices for what were then termed the 'solid-blotched *crispum.*' Other famous varieties came to light soon after this, such as *O. c.* var. *Lindeni* and *O. c.* var. *Luciani;* the latter, I was then informed, proved a fine source of revenue to the late Mr. Warburton of Haslinden, Lancs., as he openly admitted netting £5,000 [$24,330] from duplicates.

"Returning to *O. c.* var. *Pittianum;* this plant grew luxuriantly, duplicated freely and within three years gave a beautiful spike of fourteen flowers, the lower and largest of which measured four and a half inches across the petals, beside which, the colour was regal. It was exhibited and awarded a First-Class Certificate by the Royal Horticultural Society's Orchid Committee, and a Gold Medal was recommended, but never awarded at that time; how-

ever the plant was awarded a Gold Medal by the Manchester and North of England Orchid Society. This Orchid was then so far in advance of its type that nothing would tempt Mr. Pitt to permit the sale of any duplicate, although many very tempting offers were submitted from many people at home and on the Continent, until at last Mr. Pitt conceived the idea of having what he termed a clearance sale, to dispose of a considerable quantity of plants he no longer wished to retain. He came down to Cooksbridge where we held about two hundred of his choicest Odontoglossums, which then represented, and would have realized, £12,000 [$58,392] to £15,000 [$72,990]. Among these were the then famous *O. c.* var. 'F. K. Sander,' for which £1,500 [$7,299] was paid, and for which my late father offered Mr. Pitt £2,000 [$9,732] for the two front bulbs—without success.

"Before the above-mentioned sale took place, I was commissioned to take the large plant of *O. c.* var. *Pittianum* out to the Dell, for the late beloved Baron Sir John Henry Schröder to see, and I shall never forget the real pleasure and great joy he showed in that plant. Of course, he wished to purchase it, there and then, but I could only inform him that the best duplicate would shortly be sold at Cheapside; from that day the said duplicate was urgently desired by the Baron, and he was not easily denied. However, the late Mr. F. Sander, founder of the present famous St. Albans and Bruges firm, was commissioned to purchase this plant; we could not accept the commission as we were hoping to purchase the plant at round about 700 gns. [$3,500], so imagine the tension when the price soared to 1,000 gns., and the bidding still going strong! My last bid was 1,125 gns., followed by 1,150 gns. in the Baron's interest. The auctioneer remarked, 'it is against you, McBean,' to which I replied, 'Thank God for it, Sir.'

"Following that sale, we sold a neat duplicate, one bulb and growth, at 800 gns. [$4,000] and two small duplicates at 1,100 gns. the pair, so that within five years of Mr. Pitt's purchase of the original plant, he had obtained 3,000 gns. for duplicates, and still retained the leading and best portion of this distinguished and lucrative Orchid.

"These remarks are given by the kind permission of the rela-

tives of those most nearly concerned, and, so far as figures are concerned, they can be verified for accuracy."

From "Sales of Orchids," by A. A. McBean, Cooksbridge [England]. *Orchid Review* **45:** 350-351, November, 1937.

HAS THIS PLANT BECOME EXTINCT IN MISSOURI?

A botanical curiosity which was fairly common in certain parts of Missouri until recently was a coarse, weedy kind of snakeroot known as *Prenanthes crepidinea.* It once grew in Forest Park but attempts to find it in the past three years have proved unsuccessful. The Garden would like to locate a *living* plant for Professor Babcock of the University of California, and will be glad to hear from any naturalist who knows where the species may still be found alive.

E. A.

CREATING A FLOWERING MEADOW

One of the most immediate concerns in developing the wildflower gardens at the Garden Arboretum is to provide places where meadow plants will thrive (October, 1937, BULLETIN). Much of the area is forested, and the remainder is going back to woodland so rapidly that the meadow flora, without protection, would eventually disappear. As a first step in meadow-building, a fire lane was plowed around a deserted cornfield in the fall of 1936, and the field was burned over during the following winter. The "meadow" so produced now stands out in sharp contrast to the unburned areas which are either wooded or are full of thrifty young saplings.

It is one thing to start such a meadow; it is quite another to care for it successfully. There are many species such as the native hibiscus and the cup-plant which should be encouraged. There are others, most particularly the giant ragweeds, which must be eliminated. There are still others which are not present at all and which we would like to introduce. What one is really attempt-

ing is to transform a deserted corn field, once burned over, into an attractive, more or less natural perennial border, several hundred feet wide and three-quarters of a mile long. Any one who has struggled with a perennial border knows that plants cannot be left entirely to themselves; some are aggressive, others are too retiring. Collections of plants are not like collections of pictures which can be arranged at will. A wild garden is even more difficult to manage than an ordinary perennial border, since it is too big for weeding and since it must appear as natural as possible.

This does not mean that the best treatment for a wild garden is simply to let it alone. An uncontrolled wild garden is usually quite as ugly as an untended and unweeded perennial border. Had nothing been done, the meadow would be a forest of young trees like the rest of the flood plain. In a wild garden one continues to "garden," but on a larger scale. Instead of hoeing, weeding, raking, he practices mowing, erosion control, draining, pasturage, and the like. But while ordinary gardening has been carried on long enough so that its general principles have been worked out, wild gardening is still in the experimental stage. One must do it, and learn how to do it. It is, as someone once said of life, like learning to play the violin while giving a recital in front of a critical audience! In working with the meadow, therefore, we are creating a flood-plain meadow and, at the same time, learning how to create one. We first learned that a single burning will keep out most of the trees and shrubs for at least several years. We have now learned what to expect from summer mowing.

The mowing experiment was arranged so that it did not require any extra work other than the actual study of the results. For fire prevention and for getting about readily a path had been mowed through the meadow in the previous summer. Merely by shifting it to a new place this year, it was possible to study the effect of last year's mowing.

The equipment used in making the study was equally inexpensive. It consisted of a 200-foot length of string with a stick at either end. The string was pegged down in the path, or rather where the path had been last year. The plants along the string were recorded, and then it was moved over a few feet into the

unmowed area and another record was made. Only those plants which were large enough to have flowered this year were counted, and for such species as blue grass in which single plants are no longer recognizable, each square foot of sod was scored as one plant.

The meadow divides itself rather naturally into two areas and a scoring was made in each. The western end is higher and

FIG. 1. FLOOD PLAIN AT THE GARDEN ARBORETUM, LOOKING WEST. Unburned. Note trees and shrubs.

sandier; even in the unmowed portions the commonest plant is the clump-forming *Andropogon virginicus,* or beard grass. The eastern end of the meadow is lower and has a richer soil. Over most of it the predominant plants are tall ragweed, *Ambrosia trifida,* various species of smartweed (Polygonum), and a thick tangle of trumpet-creeper *(Campsis radicans).* As is shown in the following list, mowing has a similar effect on both these areas, though it affects the lower meadow more violently. Its chief consequences are to reduce the ragweed and to encourage the grasses and sedges. Though the first of these is just what was wanted, the other is

somewhat undesirable. The grasses as a whole are not very showy and they tend to be dry for considerable periods during the year, thereby increasing the fire risk. Repeated mowings, while they would eliminate the ragweed, would change the area into a very grassy meadow with a few taller perennials. This year, therefore, we are mowing by hand those spots in which ragweed is dominant and are leaving the rest of the meadow to go its own way. It is

FIG. 2. LOOKING EAST FROM THE SAME SPOT.
Burning it over and mowing ragweeds have created a flowering meadow.

already far from unattractive. The general weedy look of two years ago has disappeared. Brown-eyed Susans, asters, goldenrods, beggar's-ticks, and heleniums, make long stretches of brilliant color in the late summer and autumn. Massive groups of the cup-plant *(Silphium perfoliatum)* stand out in contrast to the lower perennials. A single specimen of the native hibiscus was a mound of white last summer and is surrounded by seedlings. The meadow is in truth becoming a meadow at the same time that we are learning how to make it one.

KINDS AND NUMBERS OF PLANTS ALONG A TWO-HUNDRED FOOT LINE BEFORE AND AFTER MOWING

BEFORE MOWING		AFTER MOWING	
Lower Meadow			
Tall ragweed	60	Trumpet-creeper	30
Trumpet-creeper	50	*Eupatorium serotinum*	22
Smartweeds (three species)	21	White aster	22
White aster	14	Sedges (several species)	20
Sorrel	15	Sorrel	25
Eupatorium serotinum	6	Smartweeds	16
Goldenrods	5	Tall ragweed	16
Curled dock	4	White vervain	9
Sedges	3	Blue grass	7
Misc. grasses	3	Goldenrods	7
Ground cherry	3	Horse nettle	2
False dandelion	2	False dandelion	2
Horse nettle	1	Curled dock	1
Nodding spurge	1	Grass	1
Cinquefoil	1	Cinquefoil	1
Self-heal	1	White avens	1
Total grasses and sedges	6	Total grasses and sedges	28
Upper Meadow			
Old field beard grass	25	Old field beard grass	61
Tall ragweed	23	Blue grass	18
White aster	18	Sorrel	13
Goldenrods	14	Tall ragweed	12
Brown-eyed Susan	13	White aster	11
Tick trefoil	10	Self-heal	11
Sorrel	10	Goldenrods	10
Trumpet-creeper	9	Brown-eyed Susan	9
Blue grass	8	Sedges	8
Strophostyles	7	*Eupatorium serotinum*	7
Eupatorium serotinum	5	Tick trefoils	6
Sunflowers	4	Beggar's-ticks	5
Horse nettle	3	Trumpet-creeper	4
White clover	3	White clover	3
Self-heal	3	Misc. grasses	8
Misc. grasses	3	Strophostyles	2
False dandelion	3	Horse nettle	2
Indian tobacco	2	Canada blue grass	1
Sneezeweed	2	Common ragweed	1
White vervain	1	Sunflower	1
White avens	1	Wild rye	1
Angle-pod	1	Blue violet	1
Cocklebur	1	Total grasses and sedges	96
Cinquefoil	1		
Strawberry	1		
Sunflower	1		
Beggar's-ticks	1		
Wild lettuce	1		
Total grasses and sedges	38		

E. A.

NOTES

Dr. George T. Moore, Director of the Garden, gave a talk to the Garden Club of Ladue, April 4, on "Organizing a Garden Club."

Mr. L. P. Jensen, Manager of the Garden Arboretum, gave a talk at the Arbor Day celebration of the Gray Summit School, April 7, on "Planting and Care of Trees."

The annual flower sermon, provided for in the will of Henry Shaw, will be preached at Christ Church Cathedral, Sunday, April 30, by Dr. Angus Dun, of the Episcopal Theological School, Cambridge, Massachusetts.

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, gave an illustrated lecture, April 20, before the Holy Name Society of St. Boniface Church, on "Exploring Texas with Camera and Tripod."

The March number of *Desert Plant Life* (**11:** 48-51) contains an illustrated article by Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, on "Exploring for Cacti in the Big Bend Country" [Texas].

A group of students from the University of Illinois Library School, in an inspection trip to libraries and other establishments, included in their itinerary a visit to the Missouri Botanical Garden Library, April 7. The party was accompanied by Dr. Errett W. McDiarmid, of the University of Illinois faculty.

Mr. George H. Pring, Superintendent of the Garden, has been invited to serve as a member of the Shade Tree and Planting Association, which was recently organized in connection with Mr. John S. Swift's gift of 110,000 Chinese elms to the school children of St. Louis. The trees were planted with appropriate ceremonies throughout the city, on April 14.

Mr. George H. Pring, Superintendent of the Garden, broadcast over Station KXOK, March 31 and April 4, on "Plant Collecting in Central and South America." On April 17 he gave a talk, illustrated with colored moving-pictures, on "Floral Displays at the Garden throughout the Year," at a meeting of the Business and Professional Club of St. John's Episcopalian Church.

Among the recent visitors to the Garden were: Mr. F. F. Rockwell, Garden Editor of New York *Times;* Dr. Earl E. Berkley, Associate Cotton Technologist, U. S. Department of Agriculture, Washington, D. C.; Dr. Harry J. Fuller, Assistant Professor of Botany, University of Illinois, Urbana; Dr. Hereford Garland, Instructor in Forestry, University of Arkansas, Fayetteville; a party of students in botany from Junior College of Moberly, Mo., accompanied by Dr. Esther Adams, Instructor in Biological Sciences.

STATISTICAL INFORMATION FOR MARCH, 1939

GARDEN ATTENDANCE:

Total number of visitors	18,440

PLANT ACCESSIONS:

Total number of seed-packets received as gifts	52

LIBRARY ACCESSIONS:

Total number of books bought	68
Total number of books and pamphlets donated	83

HERBARIUM ACCESSIONS:

By Purchase—

Avenue Camera Shop—Photographs of *Calochortus*	3
Fosberg, F. R.—Plants of Hawaii, California, Arizona, and Mexico	500
Goodspeed, T. H.—Plants of Bolivia	32
Hinton, Geo. B.—Plants of Mexico	500
Skutch, Alexander F.—Plants of Costa Rica	388
Solis Rojas, Fernando—Plants of Costa Rica	351
Sydow, H.—"Mycotheca germanica," Fasc. LXI-LXIV, Nos. 3001-3200 inclusive	200

By Gift—

Anderson, E.—Plants of Missouri and Arkansas	8
Chandler, Albert—Plants of eastern and central United States	124
Epling, Carl C.—Plants of Mexico	13
Greenman, J. M.—Photographs of types	30
Hubricht, Leslie—Lichens of Missouri	7
Lodewyks, Maude C.—Plants of Missouri	4
Martin, G. W.—Plants of Colombia, South America	7
Pyron, J. H.—Plants of Georgia	14
Royal Botanic Gardens, Kew, England—Plants of Siam	50

By Exchange—

Gray Herbarium, Harvard University—Century IX, "Plantae exsiccatae Grayanae," Nos. 801-900 inclusive	100
Purer, Edith A.—Plants of Alaska, Yukon Territory, Washington, Oregon, and California	174
	2,505

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Missouri Botanical Garden Bulletin

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas -week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

HEMEROCALLIS "SHIRLEY"

Missouri Botanical Garden Bulletin

Vol. XXVII MAY, 1939 No. 5

DAYLILIES

Have you some hybrid daylilies in your garden? You are no doubt familiar with the early lemon daylily, *Hemerocallis flava,* and the reddish or fulvous tawny daylily, *Hemerocallis fulva,* which have been growing in the older gardens for so many years. Driving along the highways, in early June, one sees along the roadsides great masses of the tawny daylilies which have escaped from the near-by gardens by means of suckers. If you are not acquainted with the many hybrid varieties of perennial daylilies now offered by the plant specialists and nurserymen, it would be well to investigate them. Naturally you want to know more about them: when they bloom, how tall they grow, what is their color, whether they prefer a damp or dry location, and whether they should be planted in part shade or in full sun, whether they are slow to become established, and when they should be planted.

Here at the Missouri Botanical Garden we began growing hybrid daylilies in 1924. In 1929 the collection was augmented by a gift of twenty varieties from the late Mr. Franklin B. Mead, of Fort Wayne, Indiana. Mr. Mead originated the variety "Hyperion," which is considered one of the finest daylilies.

Each variety of daylily has a blooming period of two or more weeks. The length of time it remains in bloom depends upon the location, the variety, and the weather. Contained in this article is a list of twenty-six varieties most of which have been growing at the Garden for ten years. During this period a record has been kept for each variety, from which we are able to give its average blooming dates for St. Louis and the surrounding territory. This list gives the time of bloom, the height, and the color.

It must be understood that the blooming period and the height of the flower stalks are variable factors that are dependent upon the location, soil, and season.

Daylilies will flourish in an open, sunny flower border. They will do reasonably well in a dry situation but much better in damp soil or even along the bank of a stream or pool. They will bloom in partial shade but never as well as in full sun; while if planted in heavy shade they will live but they refuse to bloom. Daylilies may be lifted from early spring until September, but in the spring, just as the plants are starting to grow, is the preferred time. Wash the soil from the roots with the hose and then divide the

	Height (inches)	*Blooming Date*	*Color*
Apricot	30	May 15	Apricot-yellow
Aureole	24	May 15	Orange-yellow
Calypso (night bloomer)	30	July 1	Pale yellow
Cinnabar	30	June 15	Yellow throat and reddish-bronze petals
Hemerocallis flava	30	May 5	Pale yellow
Florham	40	June 1	Deep yellow
Hemerocallis fulva	48	June 5	Deep reddish-orange
George Yeld	42	July 1	Rich orange with reddish-orange bands
Golden Bell	36	June 25	Golden yellow
Gypsy	36	June 25	Orange
Hyperion	48	July 1	Pale yellow
Kwanso	48	June 25	Double red and orange
Lady Hesketh	30	June 1	Pale yellow, fragrant
Hemerocallis luteola major	45	June 20	Apricot-yellow
Ophir	36	July 1	Orange-yellow
Orange Glow	40	June 1	Clear orange
Orangeman	24	May 15	Orange
Queen of May	36	May 25	Pale orange
Radiant	40	June 25	Rich orange
Royal	36	June 15	Pale yellow, deeper in center
Shirley	36	June 20	Apricot-orange
Sir Michael Foster	36	June 15	Apricot-yellow
Sovereign	24	May 10	Orange-yellow
Tangerine	20	May 10	Orange
Hemerocallis Thunbergii	42	June 30	Pale yellow
Winsome	48	June 15	Pale yellow

HEMEROCALLIS "HYPERION"

HEMEROCALLIS "KWANSO FLORE PLENO"

clumps, an asparagus knife being an excellent tool for such a purpose. Several eyes or shoots should be left with each division of the roots. The dwarf varieties should be spaced about two feet apart and the taller varieties about three feet. Plant firmly and water each plant before drawing all of the soil around the base. Large clumps, even those about to bloom, may be transplanted if the roots are not disturbed and the plants are watered. Daylilies may also be replanted after the blooming period, and since the weather is then quite warm the leaves should be cut back half way. Those that have been transplanted in August and September will become established before the cold weather sets in.

There are no insect pests or diseases that attack daylilies—a welcome statement, you'll agree.

Most of the early May-blooming daylilies are dwarf. Of the varieties that bloom in June we particularly like "Cinnabar," "Radiant," "Shirley," and "Sir Michael Foster." "George Yeld," "Hyperion," and "Ophir" are beautiful in early July. None of the varieties listed will bloom after July 15. Newer, later-flowering varieties are now being sold. They will prolong the flowering season but will not bloom as late here as in the East. Some varieties bloom a second time but never as freely as in their normal blooming period.

P. A. K.

HAWORTHIAS, THE DAINTY SUCCULENTS

If all the succulents in the world were to be destroyed except one group, which would you cherish? Lovers of succulent plants might balk at answering this unusual question, for so many species intrigue them that they would rather refrain from voicing partiality to any certain group. However, the curious rosette-forming Haworthias would undoubtedly be placed near the top of the list, and justly so. These Aloe-like plants, because of their diminutive size and dainty form, have always been great favorites and are destined to become even more popular. All of them may be grown indoors by the amateur with comparative ease. For a striking collection of small house plants the Haworthias can hardly be beat.

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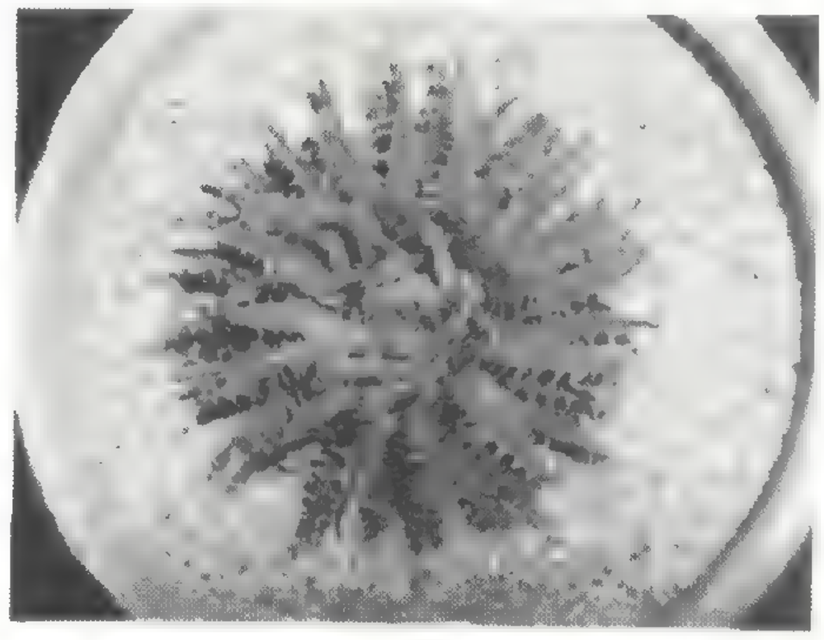

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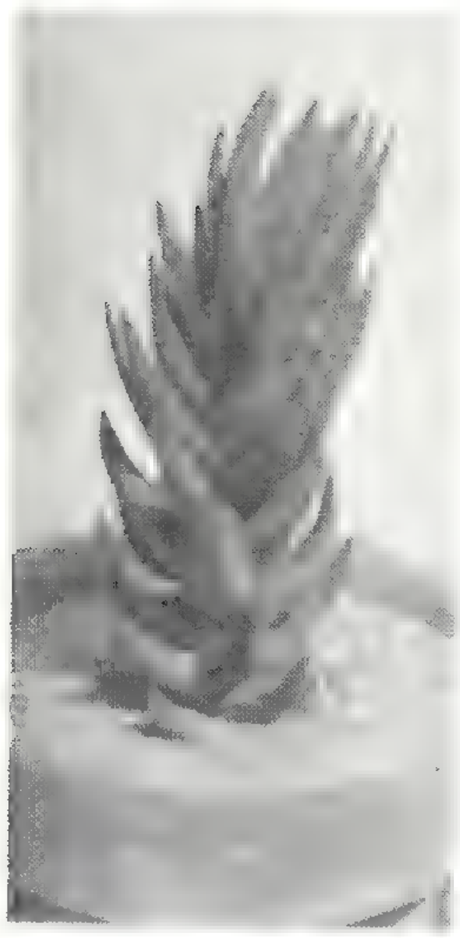

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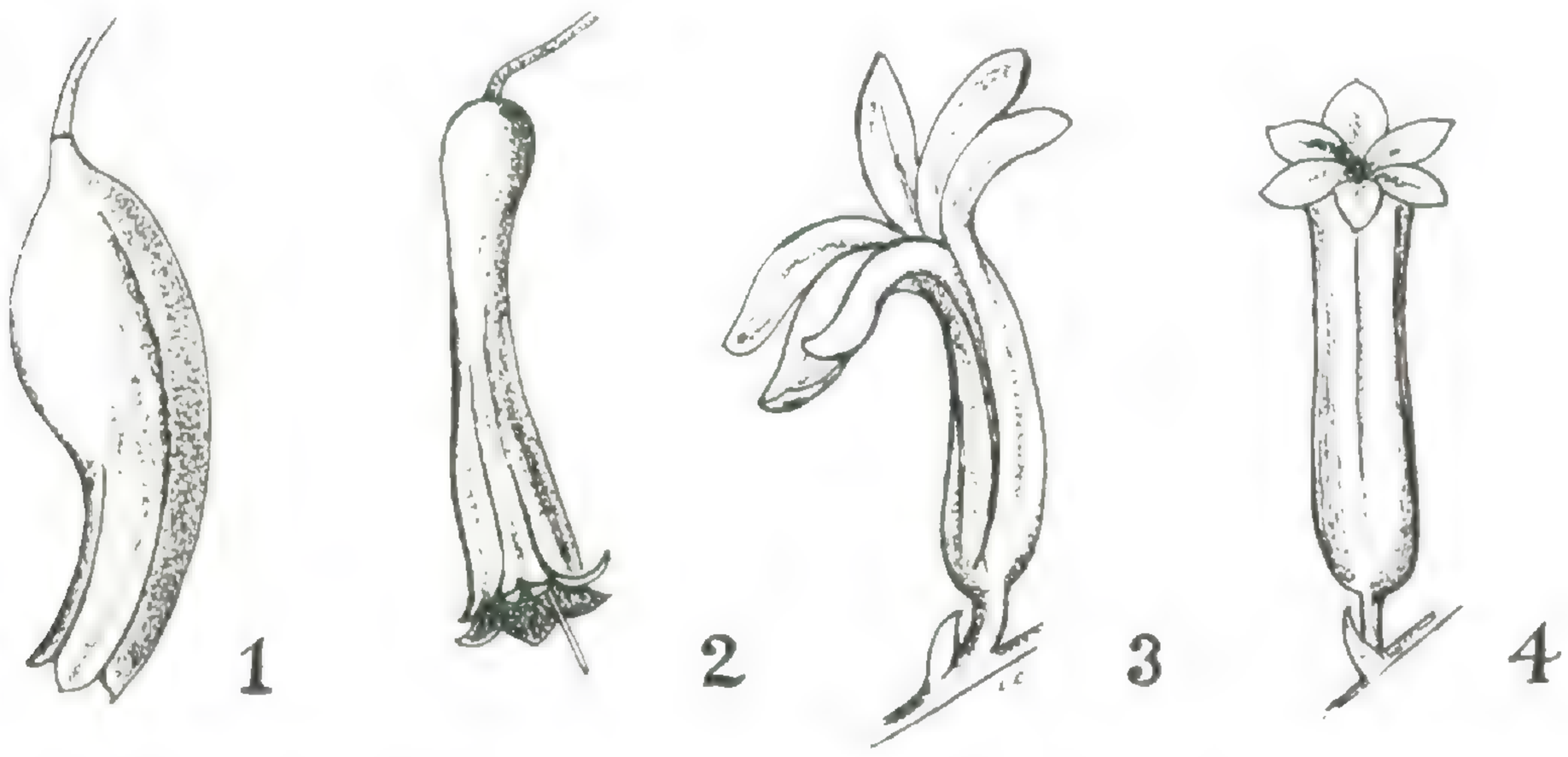
1. HAWORTHIA ATTENUATA. 2. H. SUBULATA. 3. H. FASCIATA VAR MAJOR. 4. H. PILIFERA VAR. DIELSIANA. 5. H. SETATA. 6. H. COARCTATA. 7. H. ASPERULA. 8. H. TORTUOSA VAR. PSEUDORIGIDA.

The Haworthias comprise but a small part of the large Lily family which has members in all parts of the globe and with such diverse vegetative growths that it is often difficult to realize that yuccas, dracaenas, sansevierias, regal lilies, gasterias, aloes, and tulips have affinity with each other. Only by a study of the flower will we be convinced of the more or less regular uniformity within the family. Haworthia is classed as a succulent lily, and its nearest relatives include Apicra, Aloe, and Gasteria. Each genus may be distinguished by certain flower characteristics. The blossoms of Aloe and Gasteria are large, tubular, brightly colored, and



DISTINGUISHING FLOWER FORMS OF ALLIED GENERA

1. Gasteria; 2. Aloe; 3. Haworthia; 4. Apicra. Figs. 1 and 2, about natural size; figs. 3 and 4, about twice natural size.

mostly pendulous, while those of Haworthia and Apicra are small, usually white, and usually erect or spreading. The perianth or floral envelope of Aloe is cylindrical; that of Gasteria is ventricose, meaning swollen at the base; of Apicra, stellate; and of Haworthia, bilabiate or two-lipped.

The Haworthias are mostly stemless plants, with rosettes measuring 2 to 6 inches in diameter. When they have stems, these seldom exceed six or eight inches in height and are completely covered with short fleshy leaves. The genus is wholly African, and at that only widely distributed in the extreme southern portion of that continent. Most of the Haworthias are shade-loving

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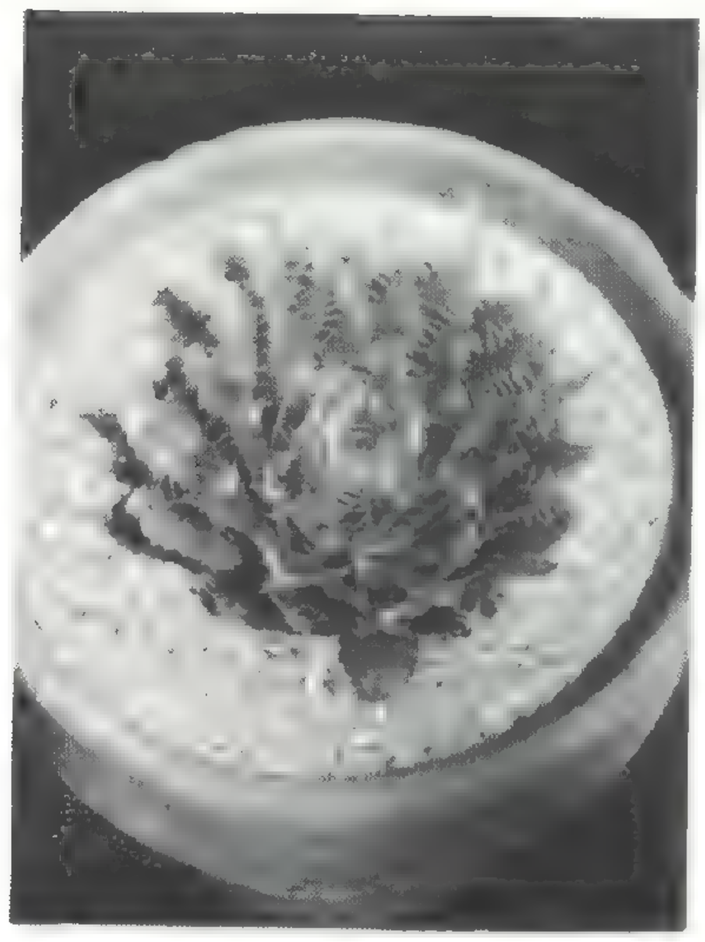

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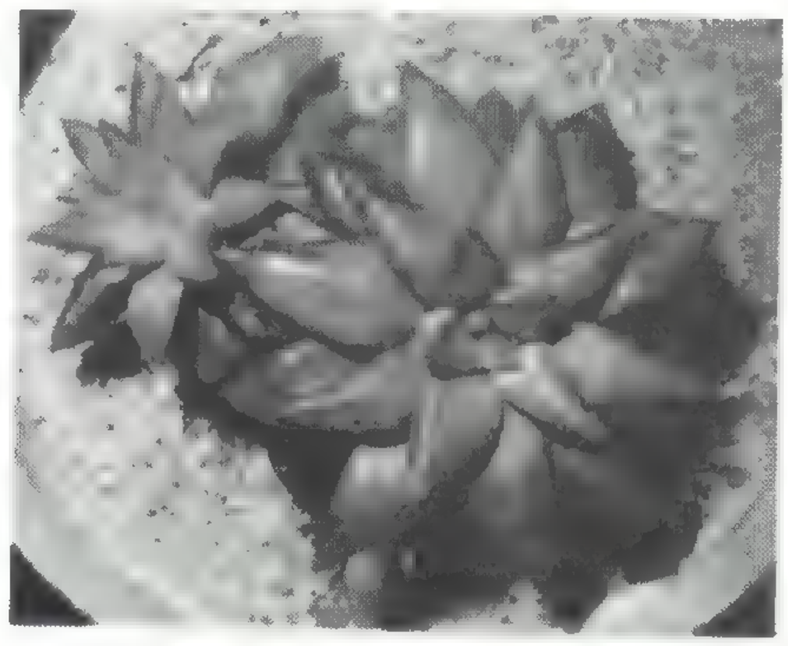

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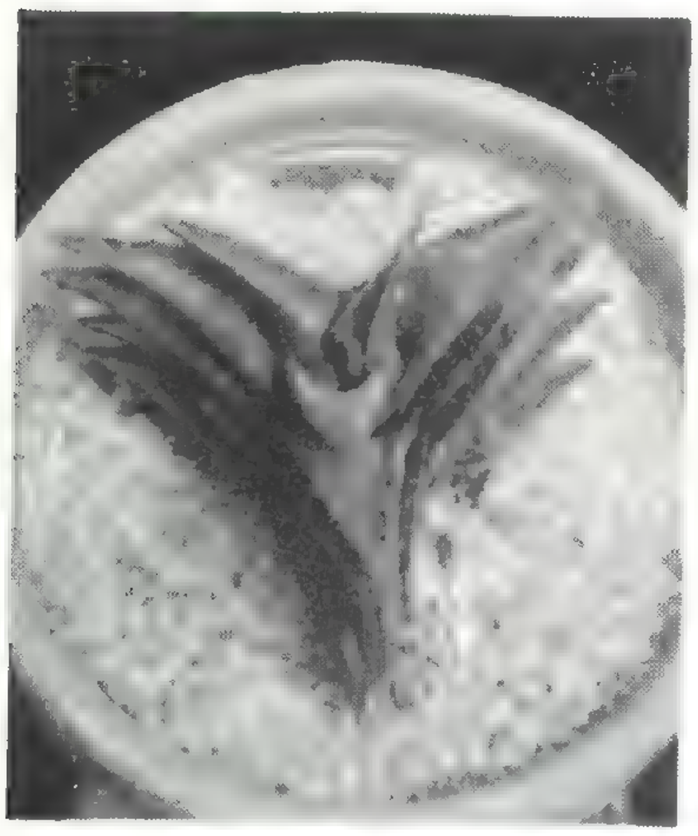

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1. HAWORTHIA MARGARITIFERA VAR. SEMIMARGARITIFERA. 2. H. ARACH NOIDES. 3. H. SP. 4. H. TURGIDA. 5. H. SP. 6. H. HYBRIDA.

plants, with a tricky way of concealing themselves under short shrubby bushes, out of harm's way, according to Mr. Hurling, a South African succulent enthusiast. Often these diminutive rosettes are difficult to locate, since some of them look like small birds' nests, others even simulate small cobwebs, and the transparent species frequently draw themselves into the ground, only the pellucid leaf portions being exposed.

In 1812 Adrian Haworth (for whom this genus is named) listed 24 species, and a quarter of a century later Prince Salm-Dyck described about 53 species in his "Monograph on Aloes." In 1908 Alwin Berger included 60 species and several varieties for this group. At present more than 100 species and varieties are known, and no doubt many more will come to light in the future. Dr. Karl von Poellnitz, of Germany, is the latest monographer of this genus, and his new species, varieties, and combinations appear from time to time in Fedde's *Repertorium,* a German botanical periodical. Mr. J. R. Brown, of Pasadena, California, has probably the finest collection of such plants in the United States and he frequently describes and figures these in *Desert Plant Life* and *Journal of the Cactus and Succulent Society of America.* Despite the large number of Haworthias, a survey of recent German seed catalogs shows only about 25 species available to the trade. However, many more species can be obtained from dealers on the Pacific Coast. Fanciers of these plants in the Greater St. Louis area are referred to the Sieloff Floral Company, located on Natural Bridge Road.

The indoor gardener, for whom this article is specifically written, rarely has extensive quarters in which to follow his hobby and must utilize only such free space as the window-sill provides. He will find in the Haworthias an answer to his urgent prayer. It is really surprising what an extensive collection of these diminutive succulents will thrive and live in just such a sunlit recess. Some of the Haworthias are great sun lovers, but a goodly number prefer semi-shade. This does not mean that they will thrive in darkened corners of the home. Light is essential, although it need not be direct. Efficient drainage is necessary at all times. Such species as *H. arachnoides, H. cymbiformis,* and *H. Cooperi,* representing the light green, transparent types, will require a more porous soil and

less water than the dark green, mottled or unspotted species such as *H. margaritifera, H. Reinwardtii, H. fasciata,* and *H. chloracantha.* Water sparingly during the dull wintry season, using the immersion method for best results. That means to place the pots in a pan of water so that the earth may become saturated with moisture from below. Never allow drops of water to remain in the crowns of the delicate-leaved species *(H. turgida, H. planifolia,* etc.), as this may start a rot or a burn.

The soil best suited for tough-leaved species, such as *H. attenuata, H. Reinwardtii,* is about half sand and half a combination of clayey loam and leaf-mold. The tender-leaved species *(H. arachnoides, H. setata, H. pilifera,* and the like) seem to prefer a light sandy soil composed of two parts of leaf-mold to one part of sand and ordinary garden loam.

Generally, Haworthias germinate within two or three weeks from time of sowing the seed. Since they are monocotyledonous plants, they will make their appearance in the form of a single leaf. Shortly, a second leaf will show itself, and before long the semblance of a rosette takes form. Seedlings most likely will have to be two years old before they condescend to throw a flowering spike. Early transplanting will usually retard the growth, unless absolute care is exercised in keeping the rootlet intact when shifting. Raising Haworthias from seed, as in the case of most succulents, is a fascinating experience, but great patience is required for this work.

Offsets and stolons are produced heavily on some plants, and these can be cut off and rooted. Any of the thick, opaque-leaved species *(H. Reinwardtii, H. coarctata, H. fasciata,* and *H. attenuata)* can be propagated from leaves almost as readily as can sansevierias, begonias, and the like. No experiments have been tried with the tender semi-transparent types such as *H. arachnoides, H. Cooperi, H. pilifera,* and *H. cymbiformis,* but it is the writer's belief that these will produce plantlets if the leaves are extracted from the mature plants, care being taken that the leaf bases are not injured in any way. Sometimes new plants may arise viviparously on the flower stalks, as often happens in the genus Agave.

In miniature desert gardens the Haworthias will prove indis-

pensable and can be used to simulate the agaves or century plants of the American deserts. These dwarf lilies are also ideal for Wardian cases, but of course they cannot be used in woodland scenes, or with the regular "sweat plants" as ferns, selaginellas, etc. A desert terrarium of neatly planted cacti and dwarf Haworthias should prove very effective on window-sills or sun-porches. These glass gardens require artificial watering only rarely, perhaps once every six to eight weeks.

Some of the more common Haworthias now in cultivation at the Missouri Botanical Garden include the following:

Haworthia attenuata Haworth (pl. 20, fig. 1).—This is one of the prettiest species of the Margaritiferae group, because of its small yet prominent chalky white tubercles which cover the under-side of the leaves. The rosettes average 4 to 5 inches in diameter, and are composed of slender attenuated leaves, 2 to 3 inches long, with minute whitish excrescences sprinkled on the face. Flower stems arise at the base of the youngest leaves and measure 10 inches in length. The peculiar flowers are about ½ inch long, the expanded lobes white with a prominent deep green stripe through the middle, the tube pink on the outside and yellow-green on the inside. This species was first introduced into cultivation about 1790. Our plant was raised from seed received on March 28, 1934, from Mr. F. R. Long, Superintendent of Parks and Town Attractions, Port Elizabeth, South Africa. Most of the Haworthias, unless otherwise stated, were received from this source and propagated from seed.

Haworthia fasciata Haworth.—This is another very beautiful species marked by prominent tubercles that converge into horizontal bands on the under-side of the leaves. There are several distinct varieties of this species, and the one illustrated (pl. 20, fig. 3) is probably *H. fasciata* var. *major,* a more robust member with longer, larger, and thicker leaves. The rosettes average 4 to 5 inches in diameter and bear numerous leaves 2½ inches long.

Haworthia margaritifera (L.) Haworth.—A plant of very easy cultivation, introduced into English gardens by Bradley in 1725. It is unique on account of the prominent pearl-like warts on both sides of its sharp-pointed leaves. Berger lists six varieties of this

species. The variety *semimargaritifera* (Salm) Baker (pl. 21, fig. 1) differs from the species in that the leaves are almost glabrous on the face and the few distinct "pearls" are restricted to the faint keels.

Haworthia subulata (Salm) Baker (pl. 20, fig. 2).—One of the larger rosette-forming species, attaining a diameter of 6 to 8 inches. Leaves about 4 inches long, greatly tapering toward the tip, and covered with small white pearls on the under-side and greenish pearls on the faces. This species was first described from a Viennese collection in 1814. It is almost identical with *H. rugosa*, which is moderately covered with small whitish tubercles on both sides.

Haworthia turgida Haworth (pl. 21, fig. 4).—This is a very beautiful species distinguished by its shape and markings on its leaves. It was introduced into culture about the year 1828. The dainty rosettes average 2 to 2½ inches in diameter, and consist of short, oblong-acute, recurving leaves that are smooth, very turgid, and marked on the upper half of the face with 5 to 7 pale green vertical lines. This plant produces numerous offsets rapidly and is remindful of some of the "hen-and-chicken" plants prominent in the Crassulaceae or Orpine family. The flower spikes are about 8 inches long, not showy but dainty, a characteristic peculiar to all Haworthia blossoms.

Haworthia asperula Haworth (pl. 20, fig. 7).—A quaint species belonging to the Retusae group, which is characterized by short, very thick, recurving leaves. The plant was introduced into England about 1823. The rosettes average 2½ inches in diameter, and consist of approximately 15 pale greyish-green leaves. The leaves are erect, abruptly recurving from the middle to the tip, with the recurved portion pellucid and scabrous as a result of the minute crystal-like papillae that cover the surface. Other related species that closely resemble this plant are *H. mirabilis* and *H. retusa*.

Haworthia pilifera Baker.—This dainty "window-tipped" species was introduced into cultivation about the year 1860 by Mr. Thomas Cooper, the gentleman who was responsible for a large number of new and interesting plants from South Africa.

The rosettes are 2 inches in diameter and consist of about 25 oblong, erect leaves that are transparent at the tips. The leaf margins and keel are edged by short, pellucid, ciliate teeth. The flowering stalk is about 11 inches tall, producing very few greenish-white flowers about ½ inch long. Dr. Karl von Poellnitz, the latest monographer of the genus Haworthia, now includes five new varieties under this species, namely *columnaris, Dielsiana, Gordoniana, salina,* and *Staynerii.*

Haworthia pilifera var. *Dielsiana* von Poellnitz (pl. 20, fig. 4).—This particular plant originally attained specific rank but now is regarded only as a variety of *H. pilifera.* Its varietal name commemorates Dr. Diels, of Dahlem, Germany. It is a very fast-growing form of the Limpidae group, the members of which are characterized by transparent apices abruptly and distinctly separated from the chlorophyll-bearing area. The rosettes are about 5 inches in diameter, composed of numerous oblong-acuminate light green leaves marked on the face and back with many longitudinal darker green lines. The margins of the leaves are sometimes smooth and sometimes covered by minute white, irregularly distributed teeth. Since all Haworthias with translucent apices are delicate in character, care should be exercised when watering. Grow in small pots, with plenty of drainage and water sparingly in the winter season. Also shade the plants from burning in the summer months.

Haworthia arachnoides (Ait.) Haworth (pl. 21, fig. 2).—This curious species is remarkable for the soft membranous spines that edge the upper portion of its leaves. It came into prominence about 1725 and was a common plant as early as 1804. The rosettes are 3 to 4 inches in diameter, and consist of densely crowded, pale glaucous leaves which are transparent in the upper third portion and marked by uneven lines on both sides of that region. The specific name refers to the teeth or spines along the keel and leaf margins which somewhat resemble the legs or feet of certain spiders. The plant grows very easily, but does not want a great amount of water.

Haworthia setata Haworth (pl. 20, fig. 5).—Belonging to the Arachnoideae group, this is a closely allied species to the pre-

ceding but has narrower leaves. It was introduced into England about the year 1818. The plant is stemless, with a dense rosette of small, dark green, lanceolate-acuminate leaves, only the awn being pellucid. Closely related species are *H. atrovirens, H. pallida,* and *H. xiphiophylla,* all characterized by cartilaginous bristles on the margins of the leaves. In catalogs this species often goes under the name of *H. setosa.*

Haworthia coarctata Haworth (pl. 20, fig. 6).—This is one of the elongated types, closely resembling the genus Apicra in habit. The stems are 4 to 8 inches long and densely crowded with erect, ascending, dark green leaves. This plant is distinguished from *H. Reinwardtii* by its height and its less spotted and more acuminate leaves. It is copiously stoloniferous and is one of the easiest species to grow. It can stand quite a bit of sun and when fully exposed will take on a purplish tinge.

Haworthia tortuosa var. *pseudorigida* (Salm) Berger (pl. 20, fig. 8).—Also an elongated type but belonging to another group which came into popularity about 1822. The plants are dark green in color, attain a height of 4 to 6 inches, and are abundantly proliferous at the base. The leaves are 1½ inches long, strongly concave on the face, rounded and keeled on the back, and finely rasp-like on both surfaces.

Haworthia hybrida (Salm) Haworth (pl. 21, fig. 6).—The identity of this species is somewhat questionable. The present plants are ten-year-old offsets from a much more mature specimen which was received at the Garden many years ago. The plant is 3½ inches high and approximately 4 inches in diameter, consisting of 25 leaves about 2 inches long. The leaves are thick, wide at the base, tapering toward the tip, and very dull green in color. The leaf faces are nearly flat, covered with minute tubercles of the same color as the plant. The under-side is rounded and faintly keeled, sprinkled with larger irregular tubercles, these tinged white in the younger leaves.

Haworthia sp. (pl. 21, fig. 3).—This plant is very outstanding, yet its identity is very puzzling. The writer has grown it from seed received under the name of *Haworthia albicans* from the National Botanic Garden, Kirstenbosch, South Africa, in 1932. In

general appearance it resembles *H. albicans,* but it lacks the contiguous white-horny margin which is a distinct feature of that species. The grower will sooner or later realize that there is great variation in this plant group and often will run up against some baffling problems to frustrate his identifications. Under greenhouse conditions, *H. albicans* will sometimes lose its ivory-white margin, but it is problematical whether it will ever show the large pearl-like warts so characteristic of the Margaritiferae group. Our plant is almost glabrous except for the very prominent "pearls" along the margins and keel. Often smaller greenish tubercles may also appear on the backs of some of the leaves, usually in the mid-section only. The rosettes are approximately 6 inches broad, consisting of about 30 leaves, at first erect, later spreading, 3 inches long, 1 inch wide near the base, and slightly more than 1/4 inch thick. In color they are a glaucous green, nearly flat on the face with a very faint keel marked by a few nearly obliterated greenish tubercles. The under-side of the leaves is rounded and strongly keeled toward the apex. On the young leaves a contiguous horny margin can be discerned at the tips.

Haworthia sp. (pl. 21, fig. 5).—This is another unique species whose identity is still shrouded in mystery. The plants in our collection were raised from seed sent under the name of *Haworthia Taylorii,* from Mr. Long, of Port Elizabeth, South Africa, on March 28, 1934. The writer has found no reference to this species except in the *British Cactus Journal,* where it is given as an unpublished manuscript name. Apparently, it is a synonym of *Haworthia Starkiana,* first described by von Poellnitz in 1934. However, *H. Starkiana,* as pictured and described in *Desert Plant Life* (November, 1935), does not seem to fit our plant. That it belongs to the Trifariae group is almost certain, and it looks like a large form of *H. viscosa.* The leaves are distinctly trifarious in arrangement, 1½ inches long, of a very dark green color, and shining.

L. C.

FRIENDS OF THE GARDEN

The response to the appeal for funds for the Garden has been most gratifying. In no sense "a drive," with personal solicitation

confined to a limited few for larger amounts, voluntary contributions have come from those who wish to express their appreciation for what the Garden has meant to them personally or because of its value as a civic enterprise.

From the many letters received, accompanied by checks, the few following extracts indicate the universal feeling of loyalty and devotion of those who wish to be enrolled as a "Friend of the Garden."

"The City of St. Louis owes a lasting debt of gratitude to Henry Shaw for the Garden that he originated and then sought to make a permanent possession of our city. We feel that loyalty to the heritage that he left to us, as well as interest in the continuing, scientific functioning of the Garden, is the least that may be expected of our citizens."

". . . Our staff thinks with me that we are under an especial obligation for the services the Garden is rendering our students. Thousands of our pupils, for purposes of study, visit the Garden each year."

"There is no doubt in my mind that Shaw's Garden is the greatest possession of the citizens of this city and state. I also feel that we haven't fully realized the attainments of the Garden and the prestige gained by the splendid displays and research."

"As you know, the Garden has always been an important part of our world."

"I am glad to send a small subscription, and be one of the 'Friends of the Garden.' Many times I enjoyed the Garden when I was a boy, and since being away from there, I have enjoyed reading the little monthly magazine."

"The Garden has meant so much to our school because I have sent groups of pupils at different times to study botanical growths. All of our out-of-town visitors never fail to visit Shaw's Garden as one of the interest-compelling graces of our city. My wife and I have visited Kew Gardens and felt our own Garden far surpasses it in public appeal."

"I hope you will not think that my love for the Garden can be gauged by the size of this donation, but my heart is much larger than my pocketbook."

In addition to the many individual subscriptions, contributions have been received from the following organizations:

Anheuser-Busch, Inc.
Board of Education Employees acting through a Committee of Supervisors, Principals, and Teachers

The Book & Flower Guild
Christ Church Cathedral, Woman's Club
Delvirs Club
Ensee Study Club
Fulton Garden Club, Fulton, Mo.
Gray Summit Lodge A. F. & A. M. No. 173
The Greater St. Louis Association of Gardeners, Inc.
Hawthorn Garden Club, Jefferson City, Mo.
Lindenwood College, St. Charles, Mo.
Literary Alumnae
Louisiana Garden Club, Louisiana, Mo.
Maplewood Garden Club Group No. 1, Maplewood, Mo.
W. H. Markham & Co.
Missouri Pottery and Supply Co.
Missouri School for the Blind
Ransome C. Bruer 32nd District Association
St. Louis Horticultural Society

The Federated Garden Clubs of Missouri, with other independent garden clubs, are actively engaged in obtaining contributions. Subscriptions have been received from England, and the states of California, New York, North Carolina, Pennsylvania, Wisconsin, and Texas. A complete list of all contributors to the "Friends of the Garden" fund will be published in the Director's Annual Report. At the time of going to press the fund for the immediate improvement of the Arboretum amounts to $36,000. A total of $50,000 is needed. The "Friends of the Garden" fund, which will be used to maintain the Arboretum after the improvements are made, now stands at $3,500. It is hoped that regular yearly subscriptions may be received to this fund and that it will amount to $25,000 annually.

NOTES

Dr. David C. Fairburn, Horticulturist to the Garden, spoke before the College Club of St. Louis, April 7, on "Spring Gardening."

Recent visitors to the Garden include: Dr. E. J. Little, Jr., of the U. S. Forest Service, Tucson, Ariz., and Mr. W. E. Hopper, graduate student in botany, University of Illinois, Urbana.

Mr. John H. Kellogg, Plant Collector at the Garden, died on May 11. The June number of the BULLETIN will contain a further note about Mr. Kellogg.

Dr. Edgar Anderson, Geneticist to the Garden, has a paper in the April 21 number of *Science* (**89:** 364-365) entitled "A Classification of Weeds and Weed-like Plants."

Mr. L. P. Jensen, Arboriculturist to the Garden, gave a talk at the tree-planting ceremony at the new grammar school, Washington, Mo., April 28, on "The Value of Trees to Posterity."

The classes in plant taxonomy and horticulture, from the University of Missouri, Columbia, under the leadership of Prof. H. W. Rickett and Prof. T. J. Talbert respectively, visited the Garden on May 13.

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, gave the lecture "Exploring Texas with Camera and Tripod," before the Nativity Holy Name Society, May 8, and before the Scottish Rite Club, May 10.

Mr. Paul A. Kohl, Floriculturist to the Garden, gave an illustrated talk, May 1, before the Northwoods Garden Club, on "Landscaping the Home Grounds." On May 2 he spoke before the Ladue Garden Club on "Gardening."

The April number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN (Vol. 26, No. 2) has been issued recently, with the following contents: "New or Otherwise Noteworthy Apocynaceae of Tropical America. VI," by Robert E. Woodson, Jr.; "Studies on Variation in *Gibberella Saubinetii* (Mont.) Sacc. (*Fusarium graminearum* Schwabe)," by Mary Goddard.

STATISTICAL INFORMATION FOR APRIL, 1939

GARDEN ATTENDANCE:
Total number of visitors.....27,189

PLANT ACCESSIONS:
Total number of plants and seed-packets received as gifts..... 825

LIBRARY ACCESSIONS:
Total number of books and pamphlets bought..... 99
Total number of books and pamphlets donated..... 343

HERBARIUM ACCESSIONS:
By Purchase
Bracelin, Mrs. H. P.—Plants of Peru, South America, by Mrs. Ynes Mexia 139
Hoogstraal, Harry- Plants of Mexico..... 101

By Exchange—

Barkley, Fred A.—Plants of Montana	1,200
Brigham Young University, by B. F. Harrison—Plants of Utah	3
Montana State University, by Fred A. Barkley	495
Los Angeles Museum—Plants of California and New Mexico, by B. Templeton	383
Naturhistoriska Riksmuseet—Plants of Europe	277
United States National Museum—Plants of Virginia	95
University of Wisconsin—Plants of central United States	135

By Gift—

Anderson, Edgar—Plants of central United States	91
Azael, Hno—*Lycopodium longiaristatum* Christensen, from Colombia	1
Bracelin, Mrs. H. P.—Plant of Peru, South America	1
Cory, V. L.—*Allium* sp., from Texas	2
Cutler, Hugh C.—Plants of western and southwestern U. S.	222
Hubricht, Leslie—Plants of Missouri and Arkansas	41
Looff, Ethel H.—Plants of Alaska	55
Petersen, Oscar—*Camassia scilloides* (Raf.) Cory f. *Petersenii* Steyermark, from Missouri	1
Templeton, B.—*Pholisma paniculatum* Templeton, from California	1
Whitaker, T. W.—*Ephedra*	13
Total	3,256

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MISSOURI BOTANICAL GARDEN BULLETIN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

JOHN KELLOGG

1862-1939

Missouri Botanical Garden Bulletin

Vol. XXVII JUNE, 1939 No. 6

JOHN KELLOGG, 1862-1939

A half century ago, in the rapidly colonized West, there grew up a pioneer band of naturalists who carried on the work of exploration begun by foreign travellers. Few of them had any regular outside support for their scientific work. Most of them worked in regions where schools were just being established and colleges and universities had not been founded or had not yet advanced to the stage of supporting research work in botany. They were individualists, as any frontiersman must have been to forsake the empire which was developing around him and give his attention to natural science. Each one of them studied botany for its own sake, even though he had to support himself by teaching a country school, by surveying, or by acting as shipping clerk. Such a man was Eggert, who ran a newspaper route in St. Louis and thought nothing of walking to Eureka or Pacific to collect specimens. Another was B. F. Bush, who supported his family by running a general store, and yet not only became the authority on the flora of western Missouri but somehow found the time to turn out scholarly treatises on difficult groups of plants. John Kellogg, though he was the last of these pioneers, was among the most outstanding. He was made so by force of circumstances which sent him as a child to Allenton, Missouri, in the days when it was a plant collector's paradise. He was made so even more by his native wit, which gave him a sharp eye for seeing things and a sharp tongue for telling others about them.

At Allenton the Meramec River, in its turnings, has left a narrow, rocky ridge two miles or so in length and three hundred feet above the river valley, its prow turned towards the south

and its eastern and western flanks channelled by ravines. Thousands of years ago the river shortened a looping course on the west, making a wide and fertile valley for Fox Creek. The St. Peter's sandstone outcrops at the base of the Allenton bluff and rises to the surface just westward and southward, producing high cliffs and deep ravines. This varied topography brought well within the range of a day's tramp many of the finest collecting grounds in eastern Missouri.

It was to such an environment that John Kellogg was taken as a small boy, a pretty lively small boy one imagines from his accounts of barn raisings and dances. "Yess'r, many's the time I went to a dance up on that hill top and danced every dance. I was a great one for dancing in those days. And for hunting, too. But I never did care for fishing, not even when I was a boy; I never could see anything to just sitting still all day long a-holding a pole."

In this botanically rich environment he had the unparalleled opportunity of having as a teacher and friend George W. Letterman, one of the ablest botanists of his time. From him Kellogg not only received an excellent foundation in elementary botany but he was introduced to other botanists, many of whom became his life-long friends. It was in this way that he became one of the collectors who collaborated in the census of the trees of the United States, undertaken by Charles Sprague Sargent, and it was for Professor Sargent that he collected the Missouri hawthorn, subsequently named *Crataegus Kelloggii* in his honor.

In 1900 Mr. Kellogg joined the staff of the Missouri Botanical Garden which he served in a variety of ways, though most of his work centered around collecting and growing the Missouri flora. In addition to his other activities, he built up a large herbarium of native plants from all parts of the state. Quite as important, however, was the help he gave to others; his time and special knowledge were always open to anyone who had a real interest in the subject. Professional and amateur botanists, students old and young who came to him for information, always went away with more than they had asked for. Sometimes, when a rare plant was not to be found, he would remember the request long afterward when the rarity was rediscovered, and bring back the spec-

imen, or seeds, or rootstock which was wanted. Along with the specimen there was information as to the kinds of places in which this particular species grew, how much it varied from plant to plant, and what country people called it, and whether it was getting less frequent than it used to be.

Perhaps his greatest genius, however, was the ability to impart his information in a way that made one remember not only the facts but the very words which he had used. It is difficult to write about him without quoting him. Various articles concerning his work appeared in the St. Louis newspapers, and it is significant that they nearly always contained some of his characteristic remarks. One time, in discussing another plant collector, he remarked: "He always has bad luck. It's never rained sugar yet but his spoon was upside down. He named both of his boys after botanists, and neither one of them ever looks at a plant."

Such a man was John Kellogg, an alert and indefatigable collector, a naturalist with a rare knowledge of plants as they grew, a botanist with the technical facts of classification at his command, a philosopher and teacher with the ability to put the truth in a nutshell. He was above all a man with a great capacity for friendship. The following article by one of his friends in the Wild Flower Club is therefore particularly appropriate.

E. A.

OUR FRIEND JOHN

By BILL BAUER

If you should visit the cemetery on Fox Creek Road, just north of 66, you would find the grave of George W. Letterman. There is a headstone indicating that he was a lieutenant in the Army but there is no date of birth or death and no epitaph.

George W. Letterman was a schoolteacher in Allenton around 1870. His methods were far ahead of the times. Every morning he stopped at the railroad station and picked up the daily paper from St. Louis. In the schoolroom there was a large map of the world, and as he read the news to his pupils they located the places on the map where the events took place.

Letterman had his pupils bring in plants, and a certain period was given daily to their study and examination.

These two examples show that Letterman was nearly a hundred years ahead of his time. If a record had been kept of his students after their school days were over it would no doubt show that they were much more resourceful than the average.

One of Letterman's pupils was John Kellogg. When John tagged along after him in the woods it must have been a wonderful sight. A real botanist indirectly instilling such a love for wild flowers into a little tow-headed boy that he never lost it!

Mr. Kellogg's powers of observation were almost uncanny. Only two years ago, when presumably his eyesight must have been somewhat impaired by age, while walking through a thick woods with members of the St. Louis Wild Flower Club, he halted the group, remarking, "There's *inermis,*" and pointed over the thick undergrowth of black haws and pawpaw to a single inconspicuous thornless honey locust among several others of the common type. His vision scanned specimens high and low like a fine-tooth comb.

His modesty was as great as his pertinacity in the hunt. One of his favorite stories was that of the country woman who ridiculed his ignorance. Stopping at a country store, carrying the basket in which he often collected specimens, he had been asked his business and had answered that he was collecting plants. The country woman peered into the basket, with the usual question about whether this or that was good to eat. Then she inquired, "Do you know Aunt Lucy?" No, he did not know "Aunt Lucy" —a name unknown to botany, and not mentioned in any herb list. The woman turned to the crowd in the store, "He says he's from the city and collecting plants and he don't know Aunt Lucy. Why he don't know nothing!" In spite of the general laugh, Kellogg persisted until he found that "Aunt Lucy" was a local name for Ellisia. In telling of this he would add, "Some other botanist must have worked in that area before me, and told them it was Ellisia; and they didn't remember the botanical name, but got it mixed up, and so Ellisia became Aunt Lucy in that neighborhood."

He was utterly fearless. Beside a swamp in Arkansas, he offered a Negro boy a quarter to wade out to a hummock for a plant he saw growing there. But the boy refused, because several cottonmouth moccasins were basking on the muddy border of the hummock. Kellogg took off his shoes and trousers and waded forth, while the snakes slid into the water as he approached. "Look out!" shouted the Negro. But Kellogg fetched his plant.

May I close this article with the notes on his last services:

"We who are gathered here today to pay our respects are just a handful of the friends of John Kellogg.

"He had many times expressed the wish that his last services be conducted by the St. Louis Wild Flower Club. On behalf of the Club, I am carrying out his wishes. We went out this morning to Allenton, his favorite stamping ground, and gathered a bouquet of wild flowers for this occasion.

"All of you no doubt have read the accounts in the newspapers. You were probably surprised to learn that John had started as a stonemason, had taught school, had been a motorman for a while, had worked in a wire factory, had worked for a medicinal farm. Many who knew him as long as thirty years did not know this. But this was typical of him for he did not talk about himself.

"The newspapers told very little of John Kellogg as we have known him—a fine companion, a good friend, sincere and kind, an inspiration to all who came in contact with him. Nothing was said about him being himself and nobody else. That's the best thing you can say about anyone. He was just John Kellogg.

"I shall never forget inviting him to my house about ten years ago to help me identify some plants. I wanted an expert from Shaw's Garden to help me, and while he was one, after that first meeting I no longer thought of him as an expert, but as my friend. That has been the experience of every one who knew him. He knew most of the plants, but when he didn't know one he had the courage to say so. He was just John Kellogg.

"In our Club the members have special names. We have the Vagabond Dreamer, the Mentor of Youth, The Tiller of the Soil, and so on. He was the Patriarch. The first part of this word comes from a Greek word meaning father, and the second part

from a word meaning leader or chief. This was a very fitting title for him. We looked up to him as a father, as our chief and friend.

"He was born in St. Louis on December 19, 1862, and was past 76. You may have guessed his physical age yet his spirit was young. Not long ago we decided in the Club that each member should specialize on one family of plants. When we asked John what he thought of the plan he was highly in favor of it, and said, 'I'll take the Sedges.' That was typical of his youthful spirit.

"He was always looking for plants new to the state, and when he found one he was as happy as a child with its first dollar. His enthusiasm bubbled over.

"Uncle John and Aunt Alice, as they are affectionately known to many people, were married July 12, 1906.

"Married 33 years, at Shaw's Garden 38 years, and lived to be 76—that's a fine record!

"All of us miss him but he would not want us to grieve. He would want us to think about the enjoyable trips we have had together. He would want us to remember the good times we had solving our plant problems. Most of all he would want us to think of him as he had been all through the years.

"He would, I am sure, want us to enjoy ourselves over some of the unusual things he said. After a trip he would always say, 'Thank you for the next ride—I already have this one.' That was typical of him.

"The true philosophical definition of religion is something in your life to which you subordinate everything else—that thing or those things in your life to which everything else is subjected. John had often said that he was not a religious man but when you consider the true meaning of the word I would say he was as religious as any of us. He devoted his life to his wife and friends and to his chosen work. He gave us everything he had.

"And so John Kellogg is gone, yet he is still here. We shall always remember him as he had been all through the years—a fine companion, a good friend, sincere and kind, and most of all, just John Kellogg.

"One of the things John enjoyed in the Wild Flower Club was

the reading of the minutes, and he particularly enjoyed the poems that were always included. And so we are going to close this service with a poem composed and dedicated to him by his friend, the Vagabond Dreamer:

"Gone but not forgotten!
Your soul remains, altho
You left us all too sudden,
Yet Death is not a blow.

"Death is the quiet surface
That after storms sustains
Our faith that life is changes
And every change a gain.

"Now you repose contented
With all the world at peace.
Your labors done, and ended
In dreamless rest. At ease!"

SPECIAL VISITORS

Mention has been made in the BULLETIN from time to time of the ways the schools of St. Louis are served by the Missouri Botanical Garden. Even more interesting is the way in which the development of school buses and of conducted trips for school children has brought this same opportunity to a much wider area. Every spring sees larger numbers of special groups brought to the Garden for recreation and instruction. This year, for instance, there have been official visits of school children from the following cities and towns in Illinois: Benld, Campsville, Canton, Champaign Co., East St. Louis, Energy, Engersham, Fairfield, Hillview, Litchfield, Meredosia, Modesto, Nebo, New Athens, Newton, Noble, Oblong, Oconee, O'Fallon, Quincy, Ramsey, St. Mary's, Staunton, Sumption, Tower Hill, Urbana, Versailles, Windsor, Wood River. School children have also come from the following localities in Missouri: Browning, Cape Girardeau, Columbia, Doniphan, Eureka, Farmington, Ironton, Kimmswick, La Grange, Lancaster, Licking, Pattonsburg, St. Louis County, Steele, Webster Groves.

Many organizations and societies schedule special trips of large groups to the Garden. Recent visitors of this sort include

the officers and delegates of the Federated Garden Clubs, the American Institute of Banking, the Ralston Purina Company, and the Ladies' Auxiliary of the Missouri Pharmaceutical Association.

DEDICATION OF THE OVERLOOK ON THE HENRY SHAW GARDENWAY

On Decoration Day the stone Overlook which has been constructed during the past year on the summit of the sandstone cliffs just east of Pacific was dedicated as a permanent feature of the Henry Shaw Gardenway. Parades from the east and west met early in the afternoon at the Overlook where the exercises were under the direction of Mr. L. P. Jensen, Manager of the Arboretum of the Missouri Botanical Garden and President of the Henry Shaw Gardenway Association. Dr. George T. Moore spoke on behalf of the Garden, and there were talks by other cooperating organizations. The climax of the celebration was the unveiling of a bronze dedicatory plaque which reads as follows: "Jensen Point. Named in honor of Lars Peter Jensen, first president of the Henry Shaw Gardenway Association. Constructed by Company 1770, Civilian Conservation Corps, under the supervision of the National Park Service in cooperation with the Missouri State Highway Department. Site donated by V. R. Smith."

NOTES

Dr. J. M. Greenman, Curator of the Herbarium, has been recently elected a correspondent of the Academy of Natural Sciences of Philadelphia.

Mr. L. P. Jensen, Manager of the Garden Arboretum, acted as judge at the flower show sponsored by the Garden Club of Hermann, Mo., on May 20.

Dr. Harry J. Fuller, Associate Professor of Botany, University of Illinois, brought his economic botany class of 44 students to visit the Garden, May 19.

On May 20, the Senior High School of Wood River, Illinois, under the leadership of Mr. W. E. Hopper, visited the Garden, including the herbarium and library.

Mr. L. P. Jensen, Manager of the Garden Arboretum, spoke at the Arbor Day Celebration, at the new grammar school, Washington, Mo., May 19, on "The Value of Trees to Man."

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, gave an illustrated lecture "Along the Cactus Trail," before the Executives Club of St. Louis, June 13.

Dr. Edgar Anderson, Geneticist to the Garden and President of the Herb Society of America, spoke before the Federated Garden Clubs of Missouri, Jefferson City, May 12, on "Something About Herbs"; on May 15, he spoke to the St. Louis Flower Show Association on "Judging Amateur Classes."

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, has an illustrated article on "Hardy Succulents" in the May issue of *Garden Gossip* (**14**:10-11). "A Review of 'Kaktusarske Listy'" (from the *Czechoslovakian Cactus Journal)* by Mr. Cutak was published in the May *Journal of the Cactus and Succulent Society of America* (**10**:198).

The temperamental *Yucca glauca,* growing beside the nearly obliterated and weather-beaten marker in the Knolls at the Garden, bloomed again in May after a lapse of four years. This historic prairie lily was originally planted by the late Dr. Charles A. Pope, in 1860. Prior to 1935 it had condescended to bloom only once, and that was in 1912, according to the records.

Recent visitors to the Garden include: Dr. W. A. Anderson, Associate Professor of Botany, University of Iowa, Iowa City; Mr. L. H. Harvey and Mr. Stephen White, graduate students, University of Michigan, Ann Arbor; Dr. Albert W. Herre, Curator of Ichthyology, Natural History Museum, Stanford University, Calif.; Dr. Philip K. Reynolds in charge of Banana Dietetic Research, United Fruit Co., New York City; Dr. J. T. Buchholz, Professor of Botany, University of Illinois, Urbana; Dr. L. O. Jimenez, of the Academia Costarriqueña, San Jose, Costa Rica.

STATISTICAL INFORMATION FOR MAY, 1939

GARDEN ATTENDANCE:

Total number of visitors.....38,174

PLANT ACCESSIONS:

Total number of plants and seed-packets received as gifts.... 235

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 48
Total number of books and pamphlets donated..... 724

HERBARIUM ACCESSIONS:

By Purchase—

Oakes Ames Herbarium, by Dr. L. O. Williams—Mexican Orchids 100
Avenue Camera Store—Photographs of *Calochortus glaucus* Regel 2
Cutler, Hugh C.—Plants of Utah and Nevada..... 323
Sydow, H.—"Fungi exotici exsiccati," Fasc. XX-XXI, nos. 951-1050 incl. 100

By Exchange—

Barkley, Fred A.—Plants of Montana and Idaho..... 9
California Academy of Sciences, by Miss Alice Eastwood—Plants chiefly from California, Washington, and Oregon.... 50
New York Botanical Garden—Photographs of *Erythrina*.... 30
Rocky Mountain Herbarium, by Aven Nelson—Plants of southwestern United States and central Canadian Provinces.... 208
Division of Botany and Plant Pathology, Central Experimental Farm, Ottawa, Canada, by Harold A. Senn—Plants of Canada 18
University of California—Plants of western United States.... 205

By Gift—

Ammerman, Elizabeth—*Thuja occidentalis* L., from Horticulture 1
Anderson, E.—Plants of Missouri..... 5
Clark, Robert B.—*Bumelia lanuginosa* (Michx.) Pers., from Horticulture 5
Cutler, Hugh C.—Plants of western United States..... 20
Fraser, S. V.—Plants of Kansas..... 9
Hubricht, Leslie —Plants of Missouri and Oklahoma..... 56
Kohl, Paul A.—*Amplectrum hyemale* (Muhl.) Torr., from Missouri 1
Natural History Museum, San Diego, California, by Frank F. Gander Plants of California..... 16
Pfeiffer, Norma E.—Plants of Georgia and Virginia..... 10
Russe, Fred, Jr.—Coniferae of Texas and Mexico..... 6
Stephani, Johanna—Fr. Stephani, "Icones hepaticarum"..... 250

Total..... 1,454

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Hove, Sussex, England

Missouri Botanical Garden Bulletin

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

1
MATERIALS FOR POTTING BULBS.

2
BULBS OF DAFFODILS, TULIPS, AND HYACINTHS, SHOWING ARRANGEMENT IN POTS AND COVERED WITH SOIL.

Missouri Botanical Garden Bulletin

Vol. XXVII SEPTEMBER, 1939 No. 7

HOW TO FORCE HARDY BULBS

During winter and early spring no house plants are more appropriate or exciting than flowering bulbs, especially if you raise them yourself. Most indoor gardeners are familiar with the technique of forcing the common paper-white narcissus in shallow bowls of moist gravel, but relatively few attempt the culture of the more difficult hardy bulbs such as tulips, hyacinths, and daffodils. Actually these bulbs are not at all difficult to force into flower if their growth requirements are known and observed. Amateurs who may wish to try raising a few bulbs the coming season should give the following details careful consideration.

When to obtain the bulbs.—Bulb catalogues from various seed stores and nurseries are generally available in September or October. They may be had for the asking and contain helpful information regarding the different varieties on the market. It is a wise plan to order the bulbs early in September, or at least by the first of October, as the stock is sometimes limited.

Type of bulbs for forcing.—For best results always insist on large bulbs of top quality. The process of forcing plants into flower before their normal season requires stock with a certain amount of extra vitality. When ordering the bulbs it is essential to specify that you want them for forcing, not for outdoor planting. In the case of daffodils be sure to get "double-nosed" bulbs as they produce more flowers than the "single-nosed" type.

Special pre-cooled bulbs are available for extra-early forcing, which makes it possible to have daffodils in flower before Christmas and tulips by the end of January. If flowers are not wanted before February 1, it is best to use the untreated bulbs as the pre-cooled bulbs are apt to grow too fast at that time of year, producing inferior results.

Planting time.—At the Garden the bulbs are usually potted by November 1 in order to have them in flower in February and March. Of course this planting date can be adjusted to suit your own plans. For extra early forcing, the bulbs should be planted in September. For late forcing they should be potted and stored in trenches or cold-frames before the ground freezes.

Planting the bulbs in pots.—The size of the flower pot used depends on the size of the bulbs and the number desired in each pot. For just one bulb a standard 4-inch flower pot is sufficient. When three or more bulbs are grouped together, a 6-, 7-, or 8-inch bulb pan is a desirable container. Bulb pans are not as deep as the standard flower pots. The 6- and 7-inch (diameter) pans are convenient to handle, but the 8-inch gets to be quite heavy when filled with soil. For tulips planted in groups of three the 6-inch pans are just right. Daffodil and hyacinth bulbs are larger and require a 7-inch pan for a group of three (pl. 23, fig. 2). All bulb pots should be thoroughly cleaned and soaked in water before using.

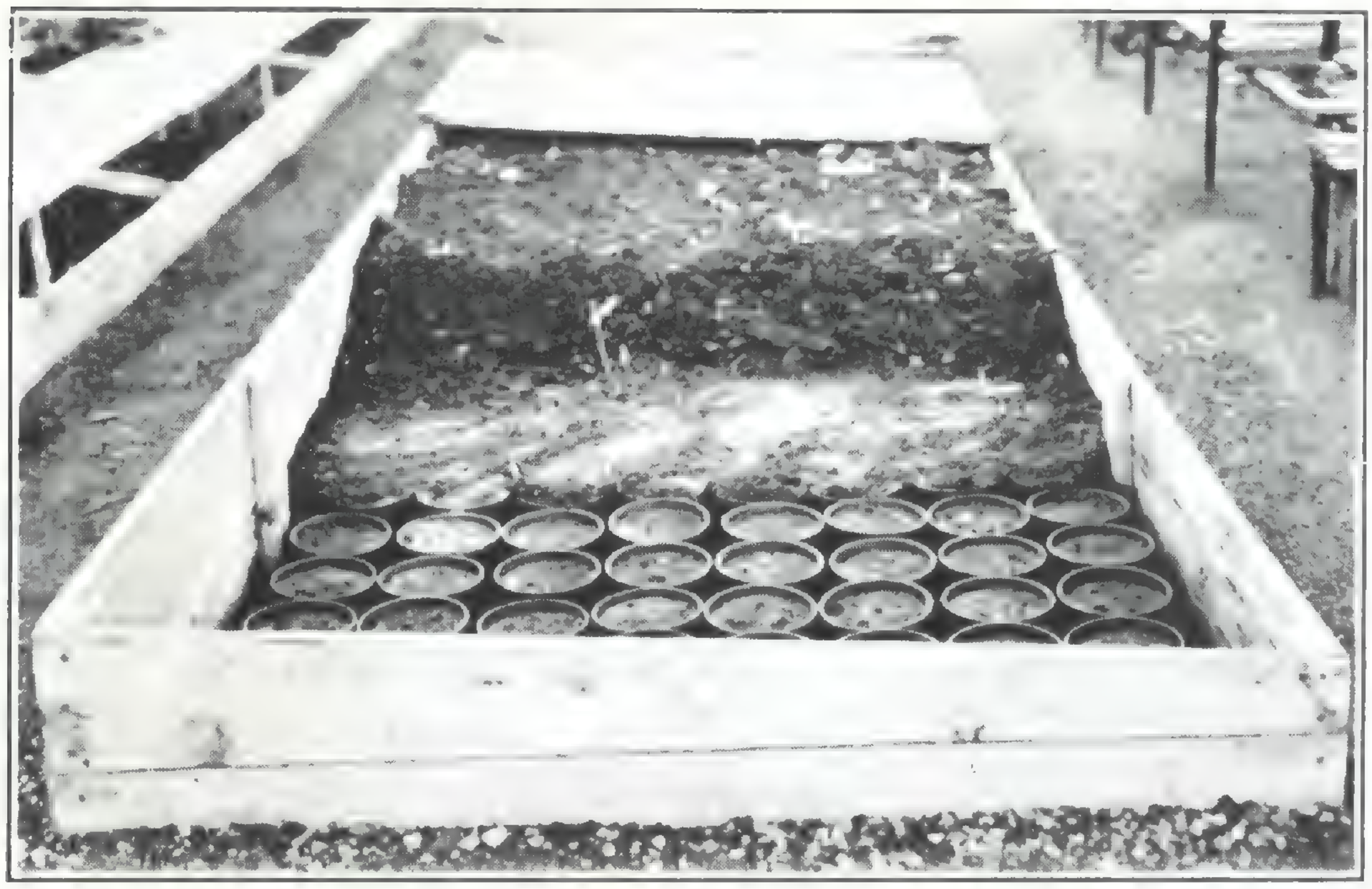
Bulbs do well in a fibrous loam soil of the following composition:

2 parts garden soil (usually heavy clay!)
1 part leaf-mold or well-rotted stable manure
1 part fairly coarse sand

If the leaf-mold or stable manure cannot be obtained, commercial pulverized cattle manure or peat may be used, although the latter is not to be considered a worthy substitute. These bulbs contain a lot of stored food, but they produce better foliage and flowers if additional nutrition is obtained from the soil. Since peat is practically devoid of plant-food elements, it can hardly be recommended as a substitute for manures or leaf-mold. On the other hand, strong commercial (inorganic) fertilizers such as ammonium sulphate, potassium nitrate, etc., *should not* be used. If you think a bit of fertilizer is needed, add 1 to 1½ pounds of steamed bone meal to each bushel of the prepared soil.

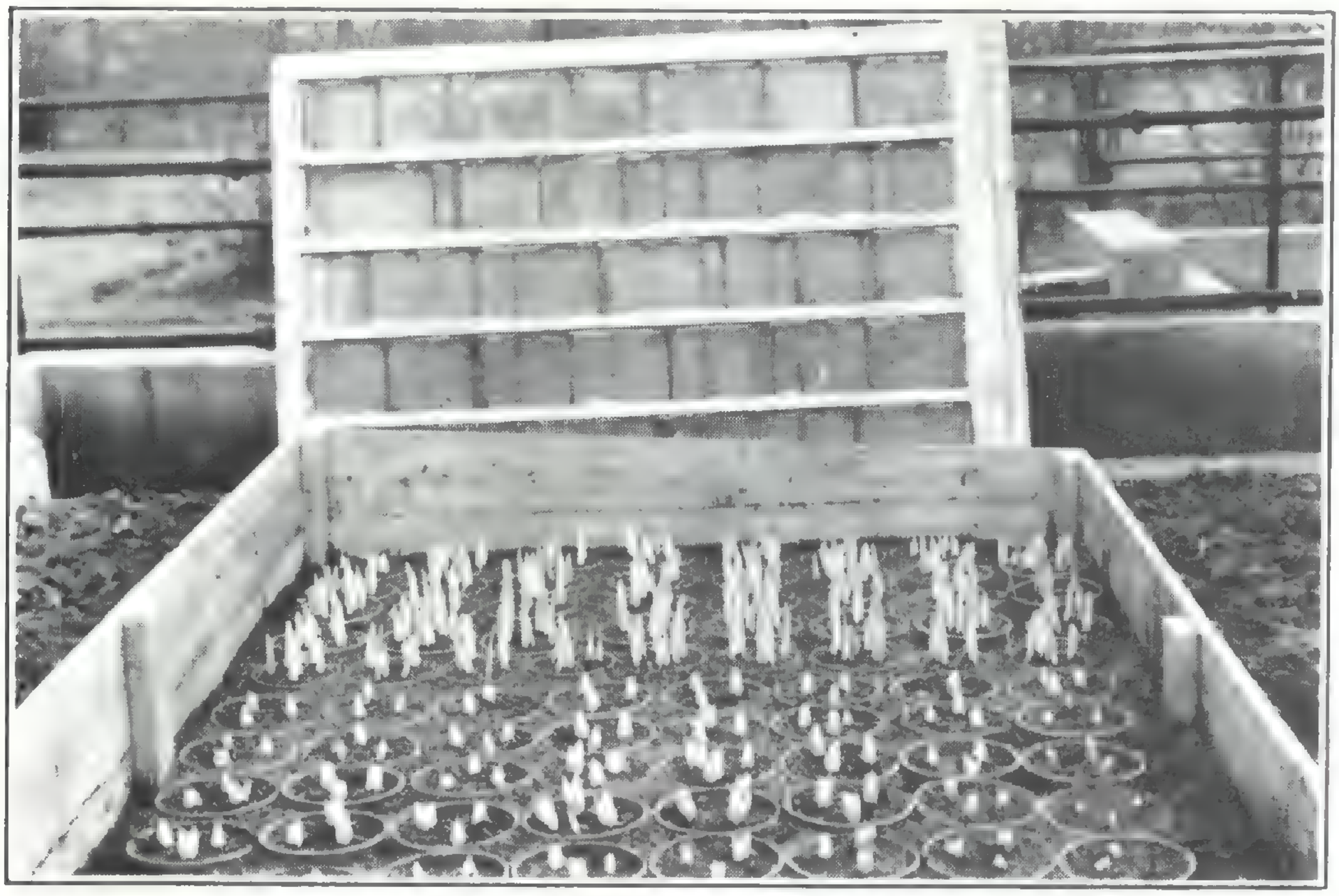
The necessary materials for potting bulbs are shown in plate 23, fig. 1. Following are the various steps in the process:

1. Perfect drainage being essential, a generous handful of broken pottery should be placed in the bottom of the bulb pan.



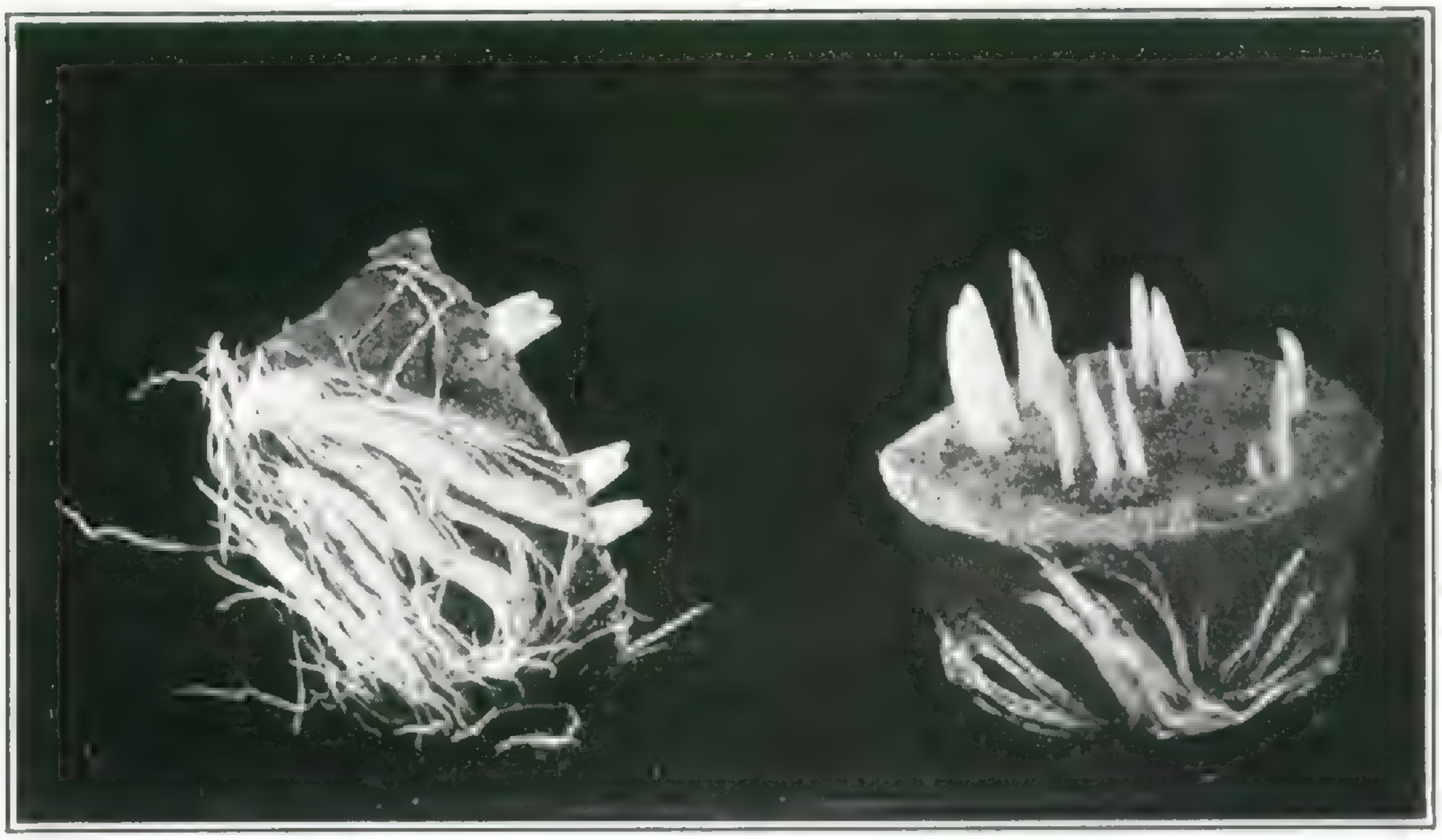
1

ARRANGEMENT OF BULB POTS IN COLD FRAME. NOTE THE PEAT SAND MULCH ON THE POTS IN THE BACKGROUND. ALSO THE SASH COVERS ON THE COLD FRAME.



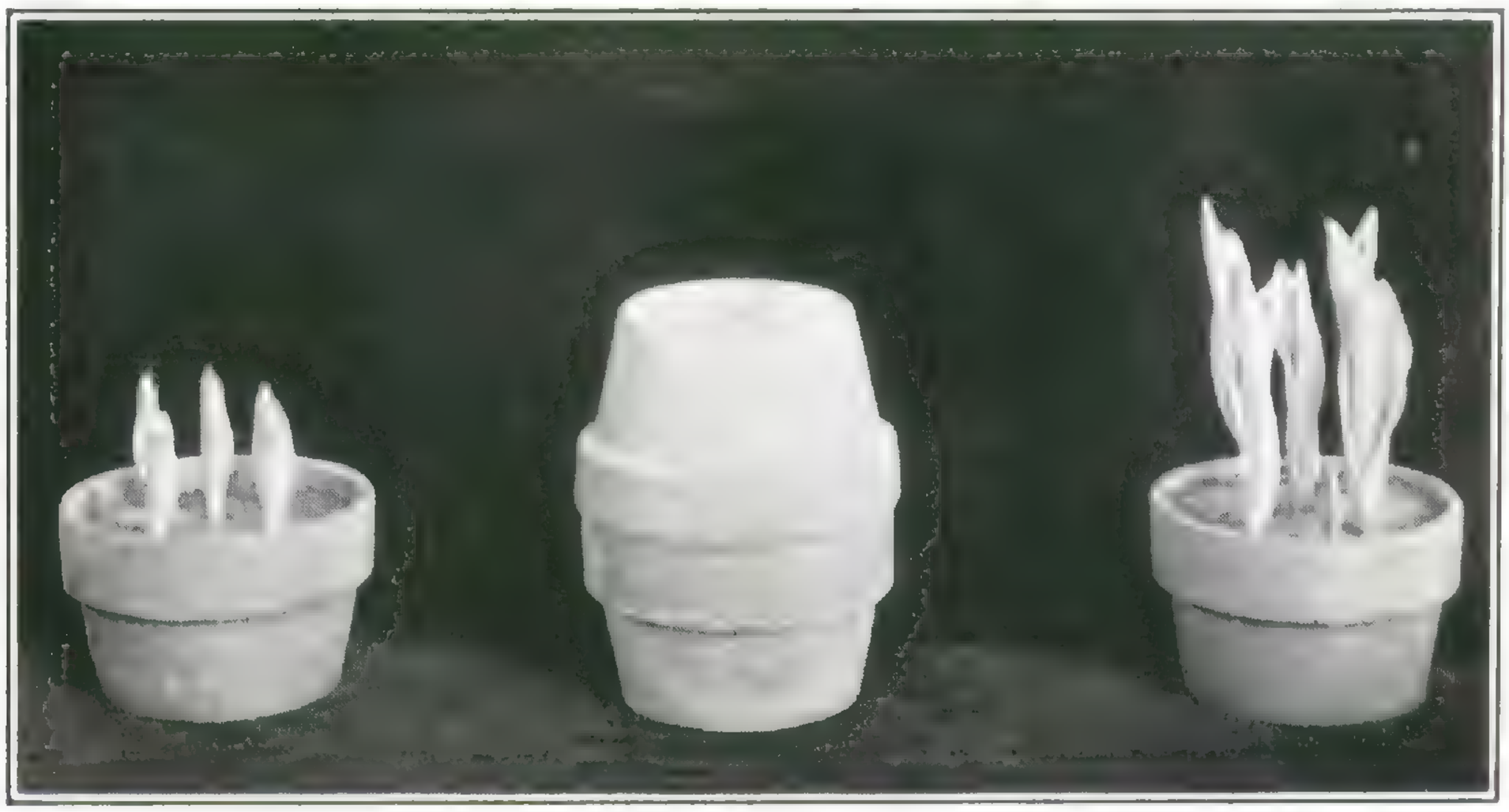
2

THIS IS WHAT THE BULBS LOOK LIKE IN FEBRUARY WHEN THE MULCH IS REMOVED.



1

THE BULBS SHOULD BE WELL ROOTED BEFORE THEY ARE BROUGHT INDOORS FOR FORCING. LEFT: HYACINTHS: RIGHT: DAFFODILS.



2

BEFORE AND AFTER SHADING TULIPS TO ELONGATE THE FOLIAGE AND FLOWER STALKS. THE INVERTED-POT METHOD IS SHOWN.

2. A layer of the prepared soil covers the drainage material, the thickness of this layer depending on the size of the bulbs.
3. Then the bulbs are evenly spaced about one inch apart on the layer of soil in the pan. The tips of the bulbs should be one inch below the rim of the pan. Tulip bulbs, which are relatively flat on one side, are best arranged with the flat sides outward. This leads to better spacing of the flowers and leaves which emerge from the flat sides. Hyacinth and daffodil bulbs require no special arranging provided they are placed with their "noses" up and evenly spaced about one inch apart.
4. After the bulbs are in place, soil is poured in around them and firmed well with the fingers or a wooden tamper. When the potting operation is completed, the surface of the soil should be one inch below the rim of the pan to facilitate watering, and the tips of the bulbs barely showing above the soil (pl. 23, fig. 2).
5. The next step is to attach a label to the pan, giving the variety, color of flowers, date of potting, etc.
6. The soil in the pans is then thoroughly soaked with water.

Storage period.—After the bulbs are in pots and the soil thoroughly moistened, the next step is to store the pots in a *cool, moist, dark* place for the development of roots. Upon this rooting process depends the success or absolute failure of the project. Bulbs cannot be rushed into flower before they have developed a mass of roots inside the pots. Consequently, it is necessary to provide favorable conditions for root growth while the tops remain practically dormant. Commercial growers have specially constructed bulb cellars for this purpose. Amateurs may either store the pots in a cold-frame or in a trench in the garden. Storing the bulbs in a basement of a dwelling-house where they are exposed to dry air, furnace gases, and high temperature is a fatal error.

If the trench method is used, proceed as follows:

1. Dig trench 18 inches deep. The width and length will depend on the number of pots to be stored or the available room in the garden.
2. Put a layer of sand 1 inch deep on the bottom of the trench. A mixture of ½ sand and ½ peat also makes a fine base on which to set the pots. Gravel or well-washed pulverized cinders may be used, too, but I prefer the peat-sand mixture.
3. Place the bulb pots in a straight row in the trench.
4. Fill around and over the pots with the peat-sand mixture until they are covered 6 to 8 inches deep.
5. Sprinkle with the garden hose until the peat and sand are thoroughly moist all the way down to the pots.
6. The final cover consists of about 6 inches of dry leaves with a few boards or wire netting to hold them in place.

By this method it is always possible to inspect or remove the pots even in extremely cold weather. If the pots are embedded in soil, it may be neccessary to dig them out with a pick and shovel or blast! Naturally when the soil freezes solid it is well-nigh impossible to get them out without damaging the pots and the tender sprouts. Furthermore it is hard work. A single trial will prove the value of the peat-sand mulch idea.

The most convenient way to store the bulbs is in a cold-frame. The frame illustrated (pl. 24, fig. 1) is simply an over-sized box with the bottom removed and the sides partly embedded in soil. It is 24 inches deep on the north side and 18 inches deep on the south side, thus providing a 6-inch slant for the covers or sash to shed water. Any one who can manipulate a hammer and saw safely can build such a frame. The sash may be purchased ready made at a reasonable price. The same type of mulch is used in the frame as in the trench. When all the mulch is in place, the frame is covered with the sash illustrated in the background of plate 24, fig. 1 (photographed October 26, 1938).

The bulbs must be kept moist at all times. Another advantage in using the peat-sand mulch is that it holds the initial moisture for several months and makes watering during the winter unnecessary. Favorable temperature for root development is around 35 to 40 degrees Fahrenheit.

When to move the pots indoors.—The bulbs must remain in storage until the roots look somewhat like those illustrated in plate 25, fig. 1. However, do not expect the tulips to develop root systems as large as the daffodils and hyacinths. To determine the progress of the roots from time to time excavate a sample pot of bulbs, turn it upside down, and extract the ball of soil by tapping the rim of the pot on a solid wooden surface. If the bulbs are taken into the house before they are well rooted, the results will probably be similar (or worse) to those shown on page 143 (fig. 2).

When the roots are properly developed, the mulch is removed and the pots brought into the house for forcing. *Caution:* do not transfer the pots in freezing weather, as the young shoots are apt to be injured by the cold, causing the leaves to be deformed and brown at the tips. It is best to wait until the temperature is around 35° F. It will be noted that the tops have grown slightly

and are white to yellow from being in total darkness. This stage is illustrated in plate 25, fig. 2 (photographed February 5, 1939).

Indoor requirements.—When the bulbs are brought into the house, the pots and sprouts will present a better appearance if sprayed with cold water to remove adhering sand, etc. Essential

FIG. 1.
A pan of white hyacinths makes an attractive window decoration.

FIG. 2.
Bulbs forced before adequate roots have formed never do well.

cultural requirements that must be carefully attended to at this time include:

1. Cool temperature—50 to 60° F.
2. Soil moist at all times.
3. Humid atmosphere.
4. Full sunlight until the flowers appear.

Above all things *do not* place the bulbs close to a hot radiator. The heat dries out the soil, kills the roots, and ruins the flowers as well as the leaves. A south window in a cool sun-room is an excellent location for bulbs. Low temperature makes for sturdy top growth, larger flowers, and longer keeping qualities.

Hyacinths and tulips generally need some shading for a week or more after they are brought into the house from storage. This shading tends to elongate the leaves and flower stalks which might

otherwise remain dwarf. An inverted flower pot is a convenient shade arrangement (pl. 25, fig. 2). A small box or paper cone will serve the same purpose. Daffodils grow tall enough without any shading.

Flowering period.—Tulips and hyacinths generally bloom within four to six weeks after they are brought indoors, the length of time depending largely on the varieties. Daffodils may be expected to produce flowers within three to four weeks.

In a cool room away from direct sunlight tulips will remain in bloom about one week. Hyacinths and daffodils will stay in good condition two weeks or more. Hyacinths often develop smaller secondary flower spikes if given the opportunity. For a succession of bloom, bring the bulbs indoors from the frames at weekly intervals, only a few pots at a time.

Treatment after flowering.—After the bulbs are through blooming remove them from the pot and plant them in the garden, taking care not to disturb the leaves or the ball of soil. A good location is in among shrubbery or low-growing evergreens where they can convalesce gradually. Plant the bulbs six to eight inches deep and let the leaves ripen off naturally. As long as the foliage is green, plant food is being manufactured and stored in the bulbs for another year.

The process of forcing devitalizes bulbs considerably and they may not be strong enough to bloom again for two or three years, tulips frequently never. My own experience with daffodils and hyacinths has been quite encouraging. It pays to give them a chance. By no means is it advisable to try to force the same bulbs two years in succession. Always begin in the fall with new stock.

Varieties.—The selection of varieties is partly a matter of personal opinion and taste. This has been particularly evident in the amateur classes held at the Garden. One year most of the class members will want white hyacinths, but the next season blue or pink may be in greater demand. So far it seems we have nearly always guessed wrong! However, here is what we plan to use the coming year:

1. Daffodil

   King Alfred—a large deep yellow

2. Hyacinth
   Dr. Lieber—lavender-blue
   La Victoire—dark pink
   L'Innocence—pure white

3. Tulip
   Wm. Pitt—carmine (single)
   Mr. Van der Hoeff—golden yellow (double)

The list of varieties becomes more complicated every year, but some of the old stand-bys are hard to beat. It is well to keep in mind the fact that certain varieties force better than others.

Raising bulbs is a fascinating diversion. Try it some time. And while you are in the notion, do not overlook such good forcing bulbs as grape-hyacinths (Muscari), snowdrops (Galanthus), Crocus, and squills (Scilla). They are handled in the same way as the other hardy bulbs. D. C. F.

DESERT TRAILS AND JUNGLE PATHS IN OLD MEXICO

Ever since I can remember, the urge to travel and to live in the great outdoors has possessed me. I lived on an insatiable diet of travel books when in grammar school and I roamed with hundreds of authors, unafraid, to all corners of the world. Long before I stumbled upon a horticultural career, the desert with its fascinating flowers, inspiring scenery, and mysterious wildness enthralled me. Not until 1935 was I to realize the thrill of a real desert campfire, the pungent smell of the creosote-bush, and the mystic feel of the silent desert. Since then, approximately 15,000 miles have been traversed over trails through the golden Southwest.

The summer of 1939 saw my partner, Mr. Gus Bantel, and me rolling over the open road to new fields—into the deserts of Old Mexico for the purpose of studying and photographing plant life in its natural haunts. The scenic wonders encountered are too profuse to enumerate here, yet a faithful and accurate account of some 6,000 miles of wandering should prove an exciting Odyssey.

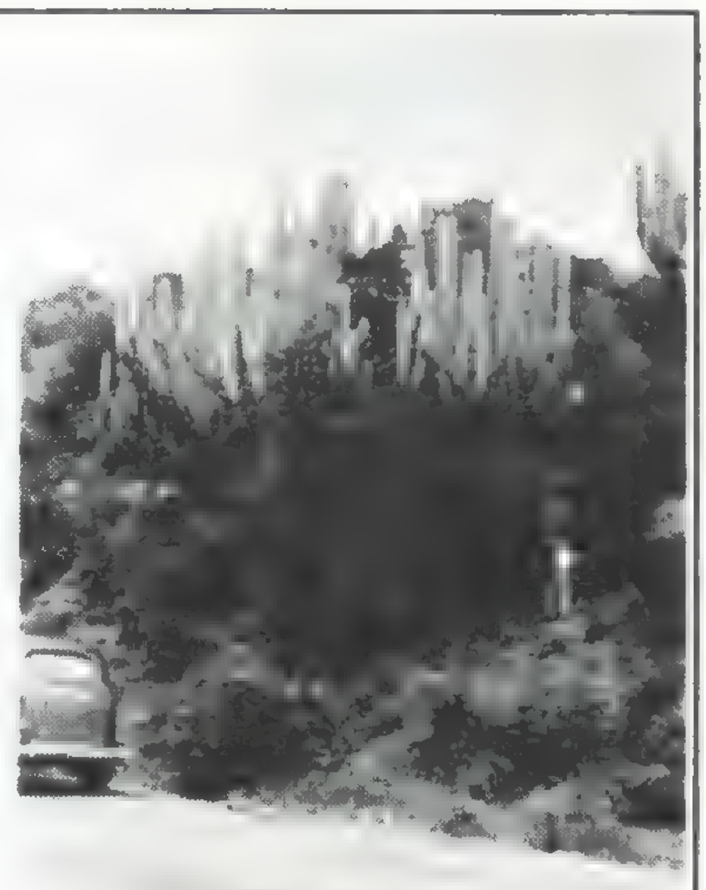
It will not be possible within the limits of this article to mention all the plants observed, but a general idea will be given of the more interesting ones found in particular localities.

Several days were consumed in northeastern Mexico, particularly in the vicinity of Monterrey and Saltillo, which embodies the cactus region of the states of Nuevo Leon and Coahuila. Some of the least frequented canyons were penetrated deeply, since Dr. and Mrs. H. A. Geitz, our hosts, and Señor Remo Damm were fully acquainted with this picturesque area. Doctor Geitz, by the way, is a St. Louis-educated physician who has been a resident of Mexico for the past thirty years. Fortunately for us, all three are great cactus enthusiasts, with a wonderful knowledge of the local flora.

No more fitting introduction to the wonders that lie in store for the adventurer could be had than the Cañon de Arteaga, which was explored as far as El Chorro, scene of the spectacular Arteaga Falls. Snuggled in between the imposing heights of the Sierra Madre Mountains, the road leads eastward from Saltillo to the quaint old town of Arteaga and literally ends at Bella Union, site of a mill supplied with water from distant Arteaga Falls. From this mud-hut village the narrow road (I guess it can be called that, in a broad sense) meanders through the picturesque canyon, following the canyon floor for a good part of the way. Often the car must be driven through rushing water, running-board deep, but to the cactus explorer the trip is worth all the obstacles.

Leaving the car in the vicinity of El Chorro (meaning The Gush or Flow, in reference to the cascading Falls), we scrambled up the steep mountain-side and every inch of ground revealed some fascinating form of desert life. Glistening silver in the sun were numerous clumps of the low clavellina, *Opuntia tunicata,* the most beautiful of the wicked chollas. At the same time, this cylindric-jointed opuntia is easily the most "infernal" cactus, ready to sink its treacherous thorns into the flesh of the unwary passer-by. Equally as alarming is the lechuguilla, a member of the Agave group, which thrives with exuberance from the canyon floor up to the highest summits. The sharp daggers of a low-growing yucca and the bandsaw-like blades of the sotol added to our discomfort; we, who were trespassers in a haughty plant domain.

1



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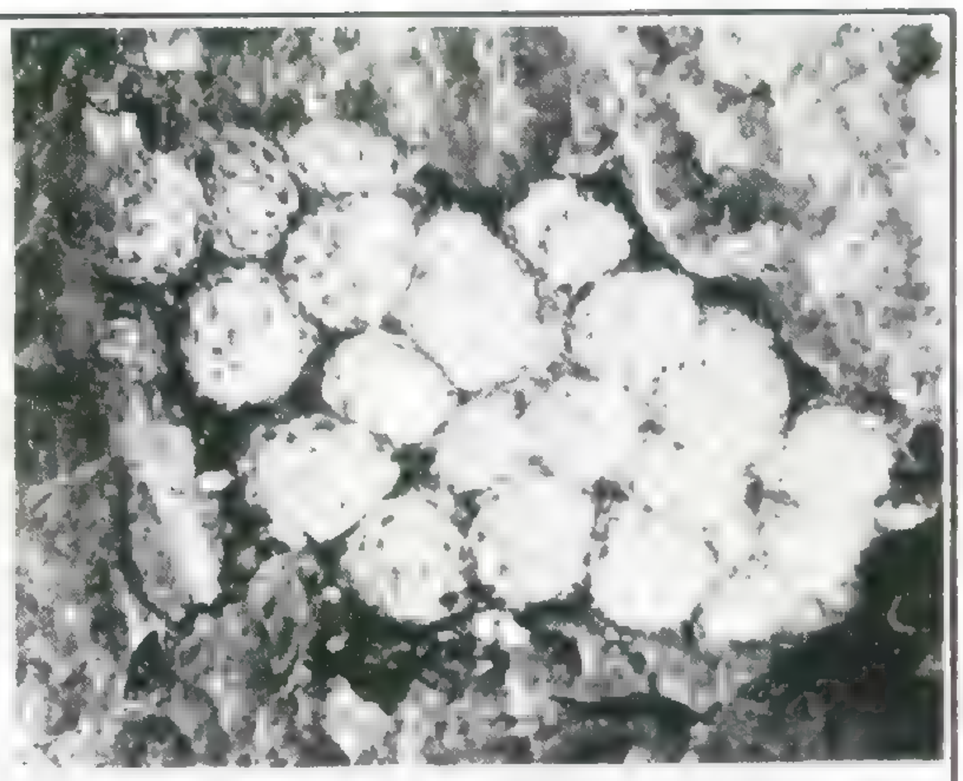
6

1. *Lemaireocereus Standleyi*. 2. *Lemaireocereus Weberi*. 3. *Pachycereus marginatus*. 4. *Mounds of Ferocactus robustus*. 5. *Mammillaria compressa*. 6. *Myrtillocactus geometrizans*.

1



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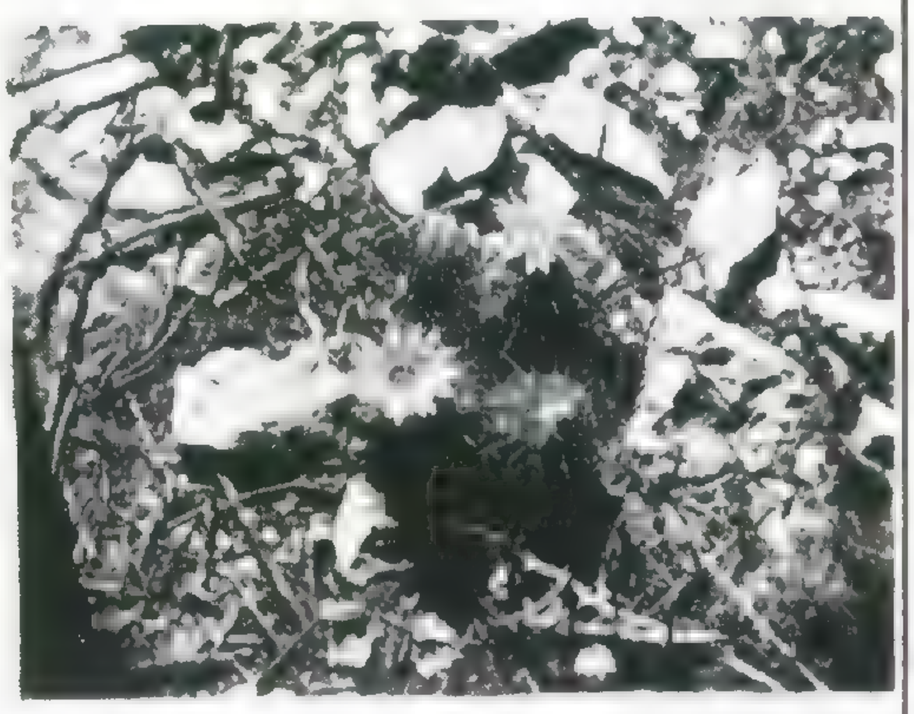

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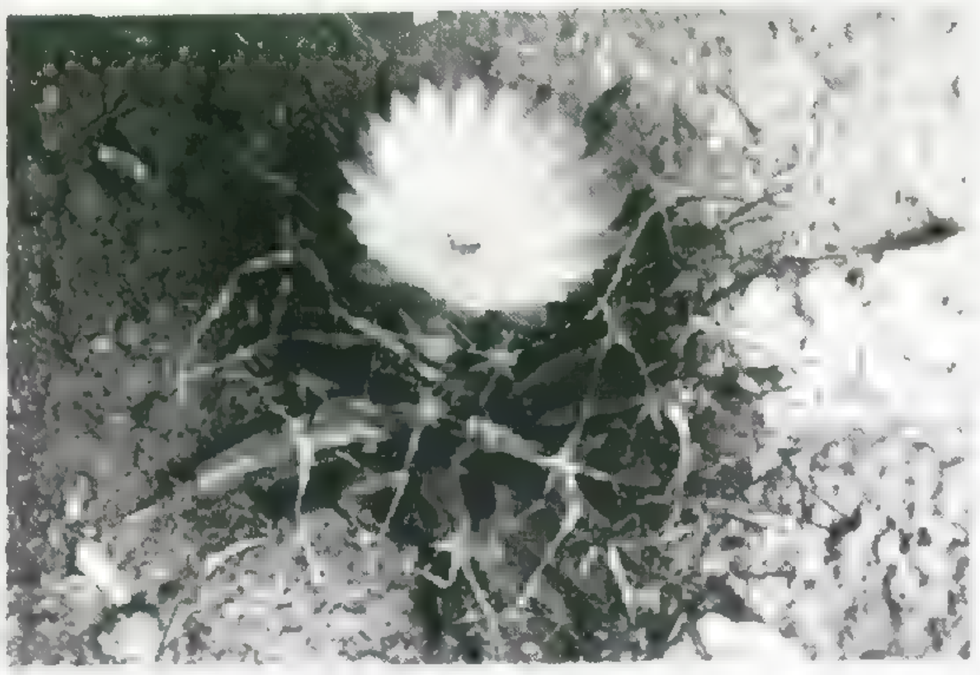

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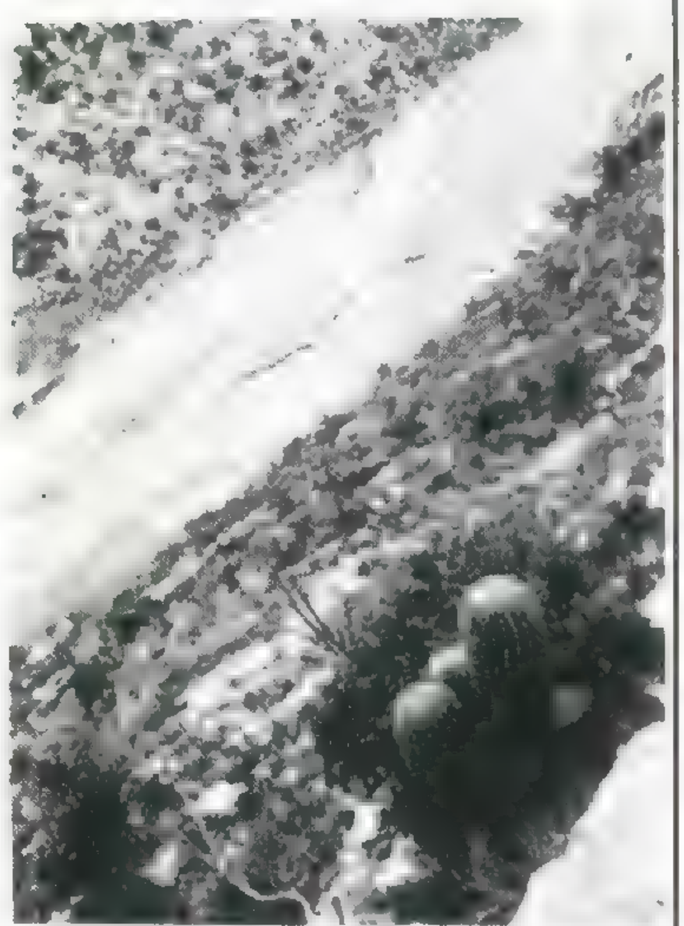

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1. *Mammillaria chinocephala*. 2. *Mammillaria plumosa*. 3. *Cephalocereus Palmeri*. 4. *Neolloydia conoidea*. 5. *Leuchtenbergia principis*. 6. *Ferocactus Pringlei*.

In the crevices and crags of rocks were growing both giant and midget forms of *Mammillaria chinocephala.* This is one of the showiest of the pincushion cacti, the beauty of which is enhanced by the snowy setae in the axils of the tubercles. The "golden plush" cactus, *Opuntia microdasys,* is another conspicuous feature of the canyon slopes. Despite its multitudinous cushions of easily detached troublesome spicules (the plant has no spines), this prickly pear is greatly prized by all collectors and makes an excellent pot plant. A member of the interesting "hen-and-chickens" clan, *Echeveria* sp., with blue-grey leaves delicately reddish-tinted at the tips and margins, found solace in the snug quarters of the rock crevices on the mountain slopes. The succulent candelillo or wax plant, *Euphorbia antisyphilitica,* is plentiful in certain sections, forming dense clusters of slender, erect, rod-like branches, up to three feet high. The surprise of the canyon slopes, however, are the tall, ruby-spined columns of *Ferocactus Pringlei,* one of the most colorful members of the "biznagas" or barrel cacti. The tallest specimen measured seven feet high; the surface divided into twenty-two more or less compressed ribs; the areoles crowned by long yellowish hairs and about six highly-colored spines which become paler in age. The prickly ocotillo waved its long, wand-like stems in the breeze, while thousands of *Hechtia texensis,* consisting of dense rosettes of spiny recurved leaves, cluttered the ground for miles around. When evening shadows began to lengthen, a cursory examination of our bodies revealed innumerable pricks, gashes, lacerations and bruises—the results of steep climbing, accidental stumbling, and unavoidable contacts with viciously armed plants that beset the path on this, our first field trip in Mexico.

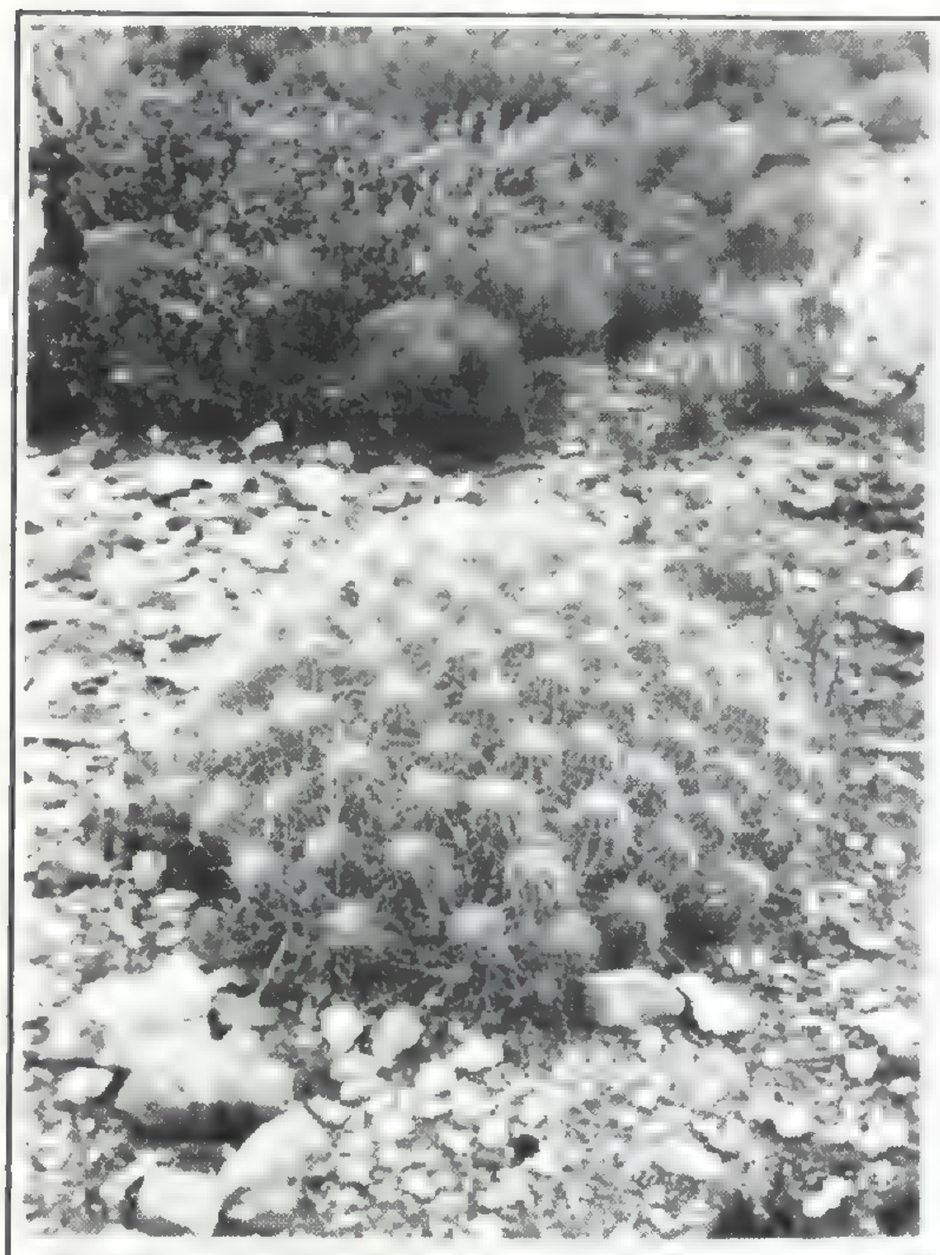
We were up early the next morning ready for the trip to Vista Hermosa and the majestic Horsetail Falls, one of the beauty spots of northeastern Mexico. Choosing a typical country road, so as to enjoy the primitive beauty rather than to speed along the smoothly-paved highways, we arrived at Villa de Santiago, starting-point for the trip to the scenic Falls. The Horsetail Falls have their start high in the mountain freshets of the Sierra Madres, and then in a series of terrifying cascades the maddened waters plunge over a 150-foot precipice before they decide on a more

placid journey through the hilly country. The trip to the imposing falls is easily accomplished, but we decided to explore further, higher and higher above the main drop. Hearts pounding furiously, we made frequent stops along the trail, and when the climb was completed a succession of fine views spread out before us in every direction. To our great surprise, up at this high altitude, we found clambering over the big boulders long streamers of the night-blooming cereus, possibly *Selenicereus pteranthus.*

At Rinconada, once a well-known cactus paradise, grow massive clumps of the long-spined *Echinocereus conglomeratus.* Clumps consisting of one hundred heads are a common sight. Another cactus, less conspicuous though very numerous, is *Neolloydia conoidea,* which produces lovely blossoms of a rich purple color. *Thelocactus bicolor,* with spiny tubercled ribs, was likewise in bloom, the plants appearing much larger than those found in the Big Bend country on last year's expedition.

Accompanied by Señor Remo Damm, we were able to explore such worth-while cactus regions as Higueras, Ojo Caliente, Saltillo, Carneros, Chiflon, and La Rosa, all westward from Monterrey, the capital of Nuevo Leon. At Higueras, a short distance west of the Coahuila-Nuevo Leon boundary, the following cacti are found in great abundance: *Coryphantha Palmeri* and *C. sulcata, Echinocereus conglomeratus* and *E. pectinatus, Lophophora Williamsii, Neolloydia conoidea, Echinocactus horizonthalonius, Opuntia imbricata* and *O. leptocaulis.* With diligent search, one is apt to find *Epithelantha micromeris, Ariocarpus furfuraceus,* and *Ancistrocactus brevihamatus.*

Thirty-five miles south of Saltillo, in the vicinity of Carneros, *Samuela carnerosana* dominates the landscape for miles and miles. This arborescent lily attains a height of five to fifteen feet and bears at the top a dense cluster of sword-like leaves. The Mexican natives frequently use the large trunks for fences and for the walls of their crude houses. From the severed leaves of the plants a sort of fiber, useful for cordage, is extracted. All of the uses to which this yucca is put can be witnessed in the region around Carneros. On the rock-strewn slopes, *Neolloydia conoidea* is so profuse that it cannot escape detection. Evidently this short-cylindric cactus produces seed freely, for thousands of "babies"



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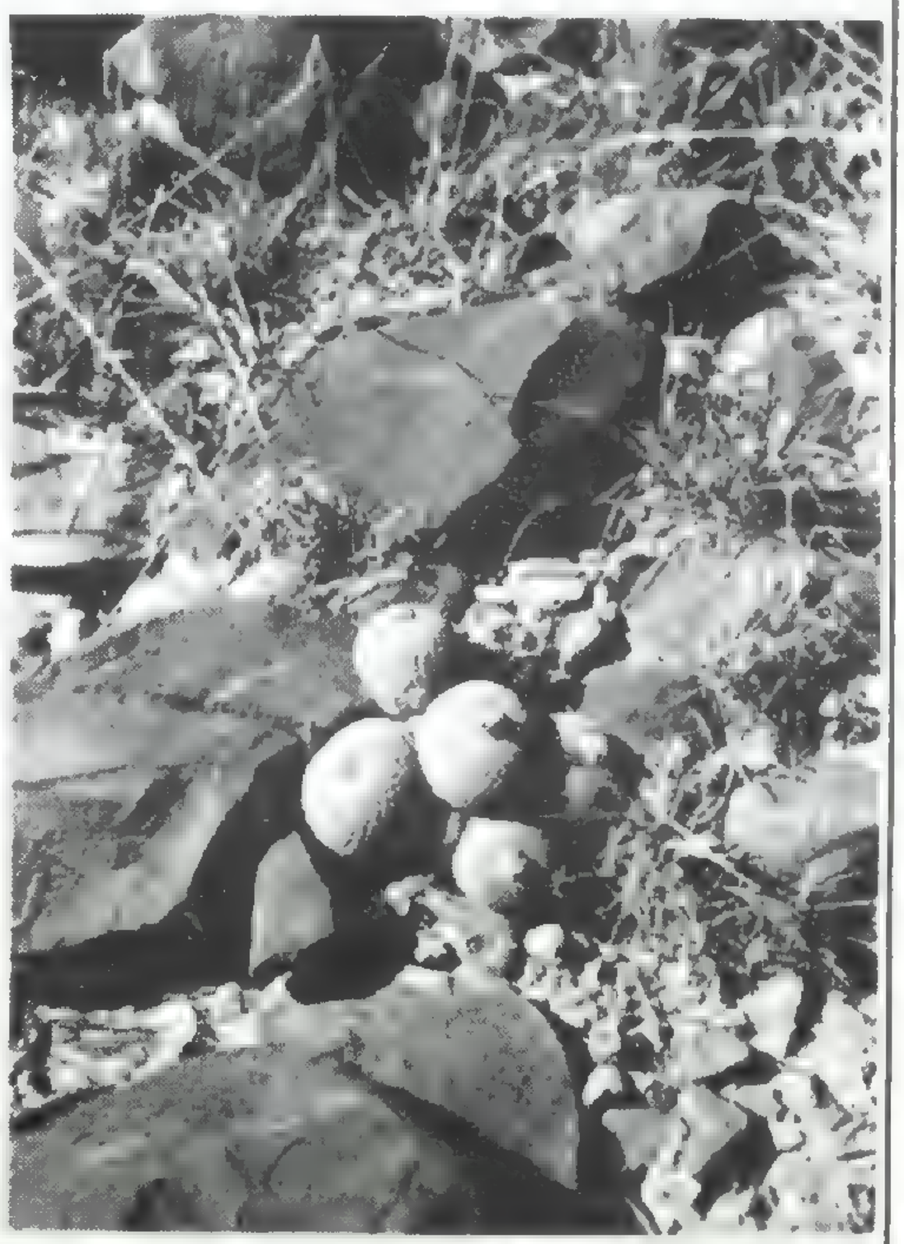

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1. *Echinocereus conglomeratus.* 2. *Ariocarpus furfuraceus.* 3. *Ferocactus latispinus.* 4. *Epithelantha micromeris.*

cover the ground in every direction. *Neolloydia Beguinii* is also plentiful, while *Mammillaria chinocephala, Ariocarpus furfuraceus, Echinofossulocactus multicostatus, Opuntia tunicata* and *O. microdasys* are prominent. The chaute, *Ariocarpus furfuraceus* has a characteristic flat head which it frequently hides in the ground, only its triangular tubercles protruding from among the broken stones. *Echinofossulocactus multicostatus,* with its very thin and wavy ribs, likewise draws itself into the ground, and the peculiar coloring makes it difficult to distinguish from the surroundings. The most striking cactus of the region, however, is the "biznaga burra" or *Echinocactus Palmeri.* This vegetable barrel, three feet high and three feet in diameter, consists of a mass of watery pulp enclosed in a furrowed waxy epidermis, further protected by stout, annular spines. *Ferocactus Pringlei* is another inhabitant of the hot, dry foothills and mountain slopes, although here it does not reach such proportions as in Cañon de Arteaga.

Midway between Chiflon and La Rosa, in Coahuila, the desert is characterized by tall branching *Yucca australis.* The creosote-bush grows rampantly, and in its shade are usually found *Coryphantha sulcata, Lophophora Williamsii, Ferocactus hamatocanthus, Echinocactus horizonthalonius,* and several other species. An interesting oddity is *Ariocarpus Kotschoubeyanus,* the tiniest of the "living rocks." It consists of a fleshy thickened rootstock and a flattened crown which very seldom appears above ground. Because of its diminutive size, its mimic coloring, and growing habit, the collector is apt to walk over the plant without even noticing it; in fact, several hours of diligent search were required before it was located. This is one cactus that must be hunted on knees.

The unique "feather-ball cactus," *Mammillaria plumosa,* was the reward of climbing the steep mountain slopes about Ojo Caliente. In this region it is the best camouflaged member of the cactus family, growing in the fissures of rocks and imitating certain fungus growths perfectly. Instead of sharp needle-like spines, which most cacti possess, this little pincushion bears soft feather-like appendages in each areole. The dainty *Epithelantha micromeris,* or "button cactus," prefers the limestone ridges, keep-

ing company with the cylindrical *Mammillaria Pottsii* and the snowy *M. chinocephala.* An Indian gathering herbs on the opposite canyon slope, far below us, loosed his emotions in the lilting songs that belong to Mexico, his musical voice reverberating in the otherwise serene surroundings.

Leaving Monterrey, the highway passes through a more or less hilly country dotted with orange groves and corn and sugar fields. In the vicinity of Ciudad Victoria the first arborescent Cerei make their appearance. *Cephalocereus Palmeri,* a close relative of the "old man cactus," is quite plentiful, especially on the hillsides, yet frequently only the hairy tops are noticed above the thick underbrush. The night-blooming *Acanthocereus pentagonus* clambers over the rocks, while the "biznaga de tuna," or *Ferocactus hamatocanthus,* condescends to send up a few showy yellowish blossoms. North of Antiguo Morelos, a peculiar Nolina (perhaps *N. Nelsoni*) with enormously thickened base and conspicuously slender trunk formed an interesting feature of the limestone hillsides. In the underbrush, writhing over the rocks and stems of bushes, we noticed an Acanthocereus and a Selenicereus, with juvenile forms of *Cephalocereus Palmeri* protruding from between the boulders.

Southward towards Valles, in the state of San Luis Potosi, the scenery gradually begins to change, and banana plants, bamboo, and palms grow in greater abundance. The villages and dwellings become more primitive and the vegetation more dense and tropical in the valleys. Almost all the huts are of bamboo with palm thatching. South of Valles lies the land of the Huastecas, a real Indian country, which until a few years ago was practically inaccessible to the white man. Tamazunchale, a picturesque little jungle village on the banks of a tropical stream, brings to mind a picture of the South Sea Isles. From here on, the real climb into the Sierra Madres begins, offering some of the most spectacular and awe-inspiring mountain scenery to be found anywhere. The Sierra Madres engulf us; mountains to the right, mountains to the left, above and below us; mountains everywhere.

The desert reappears again at Zimapan. Large colonies of mammillarias strew the ground, and huge biznagas grow in profusion, their small yellow flowers appearing from the woolly

crowns. Near Ixmiquilpan several good specimens of *Ferocactus latispinus* were noticed. Immense clusters of *Mammillaria compressa* grow under mesquite bushes and form picturesque mounds more than three feet wide. Vast fields of maguey (*Agave atrovirens*) are a common sight on the high plateau, and Indian women are frequently seen spinning the maguey fiber into balls of string as they walk along the highway. This amaryllidaceous plant has proved to be one of the most useful plants of the country. To the aborigine it served as food, drink, and clothing.

The organ-pipe cactus, *Pachycereus marginatus,* grows in miniature forests on the Mexican tableland and is widely planted about homes and country roads, serving the purpose of fences and enclosures. Even the walls of houses are made of the stems of this cactus. The short-trunked *Myrtillocactus geometrizans,* bearing the edible fruits known as "garambullos," is even more plentiful, while mammillarias, echinocacti, and opuntias form the usual undergrowth beneath the desert bushes. In the southern section of the small state of Morelos, *Pachycereus grandis* is common on the hillsides. Stately Lemaireocerei, twenty-five feet or more high, become a familiar sight about fifty miles south of Taxco and continue to be dominant in the landscape until Acapulco is reached. Particularly in the vicinity of Mexcala, in the state of Guerrero, the candelabro, or *Lemaireocereus Weberi,* is very abundant. The plants are tremendous and must weigh several tons. The numerous bluish-green branches arise from short thickened trunks, reminding one of gigantic candelabras on Nature's great altars. The pitayo, *Lemaireocereus pruinosus,* a much more slender plant than *L. Weberi,* often grows in company with the candelabro. South of Mexcala, the road passes through an artificial tunnel hewed right through the obstructing mountain, from whose almost vertical cliffs clusters of the elongated *Mammillaria guerreronis* often hang suspended. A prominent tall single-stemmed cactus, probably *Cephalocereus mezcalaensis,* grows abundantly on the slopes, and it is a wonder how these giant "toothpicks" can thrive so lustily on the meager diet stored in crevices of the almost precipitous walls.

From Chilpancingo the road continues to climb and dip but gradually loses altitude until just north of the Rio Papagayo it

enters the torrid zone, with cocoanut palms, banana plants, and plumerias dotting the landscape. The cacti do not disappear, as one would expect, but grow to the very edge of the blue Pacific. *Lemaireocereus Standleyi* finds a secure haven between giant boulders and frequently is sprayed by salty mists from the playful waves that dash against the rocks.

In southern Puebla, approximately 165 miles southeast of Mexico City, lies the Valley of Tehuacan, a most interesting cactus region to which we hied ourselves on our return journey from Acapulco. The road from Mexico City to Puebla runs through cultivated fields and gradually ascends through beautiful pine forests to an elevation of 10,500 feet, where, even in July, the nights and mornings are quite chilly. Cholula, once the proud capital of the Toltec empire, is noted for its churches. More than one hundred of these edifices are still standing, their tiled domes glistening in the sun. Beyond the city of Puebla the country changes to a semi-arid, cactus region. Near Alsesaca, in the barren limestone-covered fields, great mounds of *Ferocactus robustus* form the most striking feature of the landscape. The mounds often consist of hundreds of heads and frequently are the abodes of big black ants. Common in the calcareous soil are innumerable globular cacti, *Coryphantha pallida* being one of the more abundant species. *Opuntia Macdougaliana,* a yellow-flowered prickly pear, is very conspicuous in the Tehuacan region and also has taken hold of some of the old ruins in the vicinity of Zozutla. Several species of arborescent Cerei, particularly of the genera Lemaireocereus, Pachycereus, and Cephalocereus, thrust their spiny columns above the scrubby vegetation for miles in every direction.

The journey to Cordoba, by way of Las Cumbres de Acultzingo, is one of the most thrilling to be encountered in all Mexico. The paved highway descends with dizzying pace, dropping nearly 5,000 feet in 2½ miles, and then continues through a humid subtropic jungle on to Vera Cruz. Cocoanut palms, banana plants, coffee trees, and various tropical foliage plants supplant the cactus. With Mr. Earle Seeley of the Rancho Miraflores (specializing in gladioli) we were taken on several short field trips into secluded barrancas, where the trees are heavily laden with mas-

sive clumps of orchids, billbergias, tillandsias, and other epiphytic plants. Giant aroids and stately tree ferns grow luxuriantly beside tiny rivulets, and mimosas, the sensitive plants, hide their tangled thorny stems under a blanket of delicate foliage. Philodendrons clamber up the trees and then hang in lovely festoons from the tallest branches. And the surprise of surprises, *Bryophyllum pinnatum,* native of Madagascar, growing beside a sheltered brook in the jungles of Mexico! How did it get there? No one seems to know.

L. C.

MARKING THE SITE OF HENRY SHAW'S STORE

The Young Men's Division of the St. Louis Chamber of Commerce has recently placed the following metal shield marker at 7 North First Street:

SITE OF
EARLY HARDWARE
STORE OF HENRY SHAW

On the second floor of a building here, in 1819, Henry Shaw lived and sold hardware. The business became a factor in the early western trade of U. S. It was the foundation for his extensive estate represented today in the world famous Missouri Botanical Garden.

The erection of this marker is in recognition of the fiftieth anniversary of the death of Henry Shaw on August 25, 1889. It was from this humble beginning that Mr. Shaw began his activities in St. Louis. His association with the trade of the western expansion of the United States, his extensive investment in local real estate, and the development of St. Louis as a result of the western expansion enabled him to amass considerable wealth. There remains to-day a most valuable inheritance from that wealth as represented in the Missouri Botanical Garden and Tower Grove Park. The country possesses one of the leading botanical gardens of the world, and St. Louis a most remarkable park. They preserve for our benefit and enjoyment the wealth and a considerable portion of the pioneer estate of Henry Shaw. It is the desire that this metal shield marker just placed will inspire some permanent marking relating to Henry Shaw in the Jefferson National Expansion Memorial.

In 1934 the Young Men's Division of the Chamber of Commerce erected at 315 North Seventh Street a painting marker illustrating the city home of Mr. Shaw (now in the Garden at 2315 Tower Grove Avenue) when at the southwest corner of Seventh and Locust Streets. Shortly after, the Missouri Botanical Garden erected bronze markers on the city home (the administration building of the garden) and the country home "Tower Grove,"

SITE OF
EARLY HARDWARE
STORE · HENRY SHAW
ON THE SECOND FLOOR OF A
BUILDING HERE IN 1819 HENRY
SHAW LIVED AND SOLD HARDWARE
THE BUSINESS BECAME A FACTOR
IN THE EARLY WESTERN TRADE
OF THE U.S. IT WAS THE FOUNDATION
OF HIS EXTENSIVE ESTATE
REPRESENTED TO DAY IN THE
WORLD FAMOUS MISSOURI
BOTANICAL GARDEN.

MARKER PLACED ON SITE OF HENRY SHAW'S STORE.

and a commemorative tablet at the main entrance to the Garden at Tower Grove Avenue and Flora Place.

Historic importance of building bearing Shaw Marker.—The structure at 7 North First Street, on which the marker is now placed, is an outstanding original building (7-9-11 North First), figuring in the western expansion activity. As determined by the National Park Service in connection with their Jefferson National Expansion Memorial surveys, it is one of the two buildings still standing where the early express and overland mail offices were located in St. Louis.

NOTES

Mr. G. H. Pring, Superintendent of the Garden, has recently been appointed to the Board of the City Plan Commission.

Mr. G. H. Pring, Superintendent of the Garden, is the author of an article on "Bulbophyllum Medusae—Medusa's Head" in the July number of the *American Orchid Society Bulletin* (8: 5-6).

Mr. L. P. Jensen, Manager of the Garden Arboretum, has been reappointed chairman of the roadside development of the Federated Garden Clubs of Missouri, and has also been reelected president of the Gray Summit Garden Club.

On August 25, a wreath of orchids and magnolia leaves was placed on the tomb of Henry Shaw in the mausoleum grove at the Garden, in commemoration of the fiftieth anniversary of his death.

Mr. G. H. Pring, Superintendent of the Garden, returned in June from two months in England, where he spent some time at the Royal Botanic Gardens, Kew, and also visited various other well-known gardens.

The dragon-blood tree, *Dracaena Draco,* a famous plant of the Canary Islands, condescended to bloom for the first time at the Garden during this summer and is now bearing fruit. This relative of the lily blooms so infrequently under greenhouse conditions that the fact seems worthy of recording.

The pictorial section of the Sunday *St. Louis Post-Dispatch* (September 3) contained a two-page feature article entitled "Creating Finest Tropical Water Lilies." The Garden's introductions were described and illustrated in color, also the various steps in their artificial pollination, with Mr. Pring, Superintendent of the Garden and originator of the hybrids, posing as the operator.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has published two papers recently: "Hardy Succulents for the Rock Garden," in the June issue of the *Journal of the Cactus and Succulent Society of America* (**10:** 205-208), reprinted from the November, 1937, BULLETIN; and "Along the Cactus Trail," in

the July issue of *Gardeners' Chronicle of America* (**43:** 205-208).

Mr. L. P. Jensen, Manager of the Garden Arboretum, spoke at the dedication of a nature trail at Meramec State Park, Sullivan, Mo., July 9, on "Popular Interest in Botany"; and in Sedalia, Mo., at the garden party of the Missouri State Fair, sponsored by the state highway department and the Sedalia Garden Club, August 22, on "Some Interesting Native Plants."

On July 15 Mr. Ladislaus Cutak, in charge of Succulents at the Garden, left on a plant-hunting and photographing trip into Old Mexico. Approximately 6,300 miles were covered, searching for cacti in the states of Nuevo Leon, Coahuila, Tamaulipas, San Luis Potosi, Hidalgo, Mexico, Morelos, Guerrero, Puebla, and Vera Cruz. Following in the footsteps of Dr. Safford, who had botanized there over thirty years ago, such places as Rinconada, Ojo Caliente, Higueras, Arteaga, Carneros, El Chiflon and La Rosa, in northeastern Mexico, were visited. Tehuacan, in southeastern Puebla, a cactus region noted particularly for the genera Cephalocereus, Pachycereus and Lemaireocereus, the sub-tropic jungles of Cordoba, and Acapulco, on the Pacific Coast, were also included in the itinerary.

Recent visitors to the Garden during the summer months include Dr. F. A. Barkley, instructor in botany, University of Montana, Missoula; Dr. C. A. Brown, associate professor of botany, University of Louisiana, Baton Rouge; Dr. W. B. Drew, assistant professor of botany, University of Missouri; Dr. L. A. Kenoyer, chairman of biology department, and Mr. Frank Hinds, instructor, Western State Teachers College, Kalamazoo, Mich., with a group of their students en route to Mexico; Mr. H. E. Morris, botanist and bacteriologist, Montana State College, Bozeman; Prof. Alfred Rehder, curator of the herbarium, Arnold Arboretum of Harvard University, Jamaica Plain, Mass.; Mr. M. J. Reed, graduate student, University of Notre Dame, Notre Dame, Ind.; Dr. J. A. Steyermark, assistant curator of the herbarium, Field Museum of Natural History, Chicago; Cora Shoop Steyermark, Chicago; Dr. F. L. Wynd, assistant professor of botany, University of Illinois, Urbana.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1939

GARDEN ATTENDANCE:

Total number of visitors in June	22,963
Total number of visitors in July	29,083
Total number of visitors in August	36,048

PLANT ACCESSIONS:

Total number of plants and packets of seeds donated in June	252
Total number of plants and packets of seeds donated in July	1,862
Total number of plants and packets of seeds donated in August	99

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	36
Total number of books and pamphlets donated in June	317
Total number of books bought in July	27
Total number of books and pamphlets donated in July	366
Total number of books and pamphlets bought in August	31
Total number of books and pamphlets donated in August	147
Total number of manuscripts donated in August	5

HERBARIUM ACCESSIONS:

JUNE

By Purchase—	
Goodspeed, T. H. Plants of Peru	29
By Exchange	
Oakes Ames Herbarium–Orchids, chiefly from Central America	49
Botanical Institute, Munich—Photographs of *Calochortus*	2
Field Museum of Natural History—Plants of Missouri	1,653
By Gift	
Anderson, Edgar—Plants of horticulture	30
Cutler, Hugh C.—*Allium stellatum* Ker from Iowa	1
Fraser, S. V.—*Tradescantia occidentalis* (Britt.) Smyth var. *typica* from Kansas	1
Greenman, J. M.—Plants of Wisconsin	32
Hopkins, L. S.—*Oenothera triloba* Nutt. from Missouri	1
Hubricht, Leslie—Plants from Missouri, Oklahoma, Texas, and New Mexico	173
Oklahoma Agricultural and Mechanical College, by H. I. Featherly—*Senecio filifolius* Nutt. from Oklahoma	1
Stifler, Mrs. J. M.—*Andreaea petrophila* Ehrh. from Pennsylvania	1
von Schrenk, Hermann—*Populus alba* L. var. *pyramidalis* Bge. from horticulture	1
By Transfer—	
Fairburn, D. C.—*Pelargonium* spp. from horticulture	8
Total	1,988

JULY

By Purchase
- Avenue Camera Store—Photographs of type specimens..... 4
- Degener, Otto—Plants of Hawaii 83
- Erichsen, C. F. E.—"Lichenen, bes. vom Schleswig-Holstein" XVII u. XVIII Halbzenturie, Nos. 801-900, inclusive..... 100
- Gentry, Howard Scott—Plants of Lower California..... 352
- Skutch, Alexander F.—Plants of Costa Rica 127

By Exchange—
- Botanical Garden, University of Jagellonica, Krakow—Plants of Poland 208
- Botanical Museum, University of Helsingfors—"Lichenes Fenniae exsiccati," Fasc. VIII-XI, Nos. 351-550, inclusive 200

By Gift—
- Anderson, Edgar—*Asclepias ovalifolia* Dene. from South Dakota 1
- Cutler, Hugh C., by R. E. Woodson, Jr.—Plants of Utah, Texas, and Arizona 36
- Davis, R. J., by R. E. Woodson, Jr.—Plants of Idaho..... 5
- Hayden, Ada—Tradescantias from Iowa 2
- Herbarium, Instituto Miguel Lillo, by R. E. Woodson, Jr.—Plants of Argentina 22
- Hopkins, L. S.—Plants of Missouri 2
- Larisey, Maxine –*Baptisia* spp. from various localities..... 40

By Transfer—
- Fairburn, D. C.—Plants of horticulture 2

Total 1,184

AUGUST

By Purchase
- Bracelin, Mrs. H. P.—Plants of South America, collected by Mrs. Ynes Mexia 254
- Stephani, Fraulein Johanna—F. Stephani's "Icones hepaticarum," Delivery III 250

By Exchange-
- New York Botanical Garden Plants of British Guiana, collected by A. C. Smith 1,005
- University of California Algae 116

By Gift
- Anderson, E.—*Tradescantia virginiana* L. from Missouri.... 2
- Bracelin, Mrs. H. P.—Plants of South America, collected by Mrs. Ynes Mexia 1
- Buchholz, John T.—*Sequoiadendron giganteum* (Lindl.) Buchholz from California 3
- Churchill, Anna, part of the bequest of the late Hon. Joseph R. Churchill, about 500
- Cutler, Hugh C.—*Thermopsis montana* Nutt. from Wyoming 1
- Drew, Wm. B.—*Aristida ?* from Missouri..... 1

Field Museum of Natural History—Apocynaceae from Costa Rica	6
Greenman, J. M.—*Baptisia leucantha* T. & G. from Wisconsin	1
Greenman, J. M.—*Bouteloua curtipendula* (Michx.) Torr. from Missouri	1
Hopkins, L. S.—Plants of Missouri	5
Hume, H. Harold—*Zephyranthes*	33
Moore, D. M.—*Delphinium newtonianum* D. M. Moore from Arkansas	3
Ownbey, Francis Marion—*Calochortus* spp. from western United States	74
Ownbey, Mr. and Mrs. Francis Marion—Lichens from southwestern United States	27
Price, Mrs. Pearl—Plants of Mississippi	2
von Schrenk, Hermann—*Thuja orientalis* L.	1
Williams, L. O.—*Lisianthus nigrescens* Griseb. from Mexico	1
Woodson, R. E., Jr., and R. W. Schery—Plants of Missouri, Arkansas, Mississippi, and Florida	125
By Field Work—	
Hubricht, Leslie—Plants of southeastern United States, about	200
By Transfer—	
Kohl, Paul H.—Plants of Horticulture	3
Total	2,618

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

HERMANN VON SCHRENK,
Pathologist

EDGAR ANDERSON,
Geneticist

JESSE M. GREENMAN,
Curator of Herbarium

ROBERT E. WOODSON, JR.,
Assistant Curator of Herbarium

CARROLL W. DODGE,
Mycologist

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

WILLIAM F. LANGAN,
Chief Engineer

AUGUST P. BEILMANN,
Arboriculturist

JOSEPH LANGEN,
Assistant Engineer

DAVID C. FAIRBURN,
Horticulturist

ALBERT PEARSON,
Painter

JOSEPH CUTAK,
In charge of Exotics

LADISLAUS CUTAK,
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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXVII OCTOBER, 1939 No. 8

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

THROUGH A MOON GATE

Missouri Botanical Garden Bulletin

Vol. XXVII OCTOBER, 1939 No. 8

CHRYSANTHEMUMS

In the last twenty-three years various chrysanthemum articles have appeared in seven separate issues of the Garden Bulletin. As some of these issues are out of print the present bulletin is a revision of the previous articles with additional information on the currently popular hardy chrysanthemums.

The word "chrysanthemum" (kris-san′-thee-mum) is derived from two Greek words, *chrysos* (gold), and *anthos* (flower). Not all chrysanthemums have golden-yellow flowers, so it may well be wondered how the other colors originated. Attempts have been made to trace the origin of the modern chrysanthemum, and the popular theory that most of them were developed from the two small species, *Chrysanthemum indicum* and *C. morifolium (sinense)*, has frequently been repeated. Teizo Niwa, Professor of Floriculture and Landscape Gardening, Tokyo Imperial University, in his "Chrysanthemums of Japan," published in 1937, says: "Like most such views, they have a common grave drawback of being not the results of scientific researches, but mere inferences that are not based upon any convincing proof of experiments." Prof. Niwa supposed that after the chrysanthemums had attained a certain degree of development in China they were brought to Japan during the Era of Tempyo of the Nara Period (724-749). The chrysanthemums were first raised in the Imperial Palace where they were prized by the nobility, and later the masses took up the culture.

Holland was the first European country in which chrysanthemums were introduced, in 1688, but the plants were soon lost to

cultivation. According to *Hortus Kewensis,* a specimen of a chrysanthemum from the Apothecaries' Garden at Chelsea was presented to the Royal Society in 1764, under the name *Matricaria indica.* Credit for the first reappearance of the chrysanthemum in Europe belongs to M. Blancard, a French merchant of Marseilles, who in 1789 imported three different plants from China, a white, a violet and a purple, only the last one of which lived. Between 1798 and 1808 eight new varieties were brought from China to England. Joseph Sabine's "Account and Description of the Varieties of Chinese Chrysanthemums" appeared in Volume IV of the *Transactions of the Horticultural Society of London,* in 1822. This was quite a complete treatise of the chrysanthemum in Europe at that time. In 1885 C. Harman Payne wrote "A Short History of the Chrysanthemum," and followed this with "A History of the Chrysanthemum in Europe" in the chrysanthemum number of the *Gardeners' Magazine* in October, 1889, and again in November, 1890.

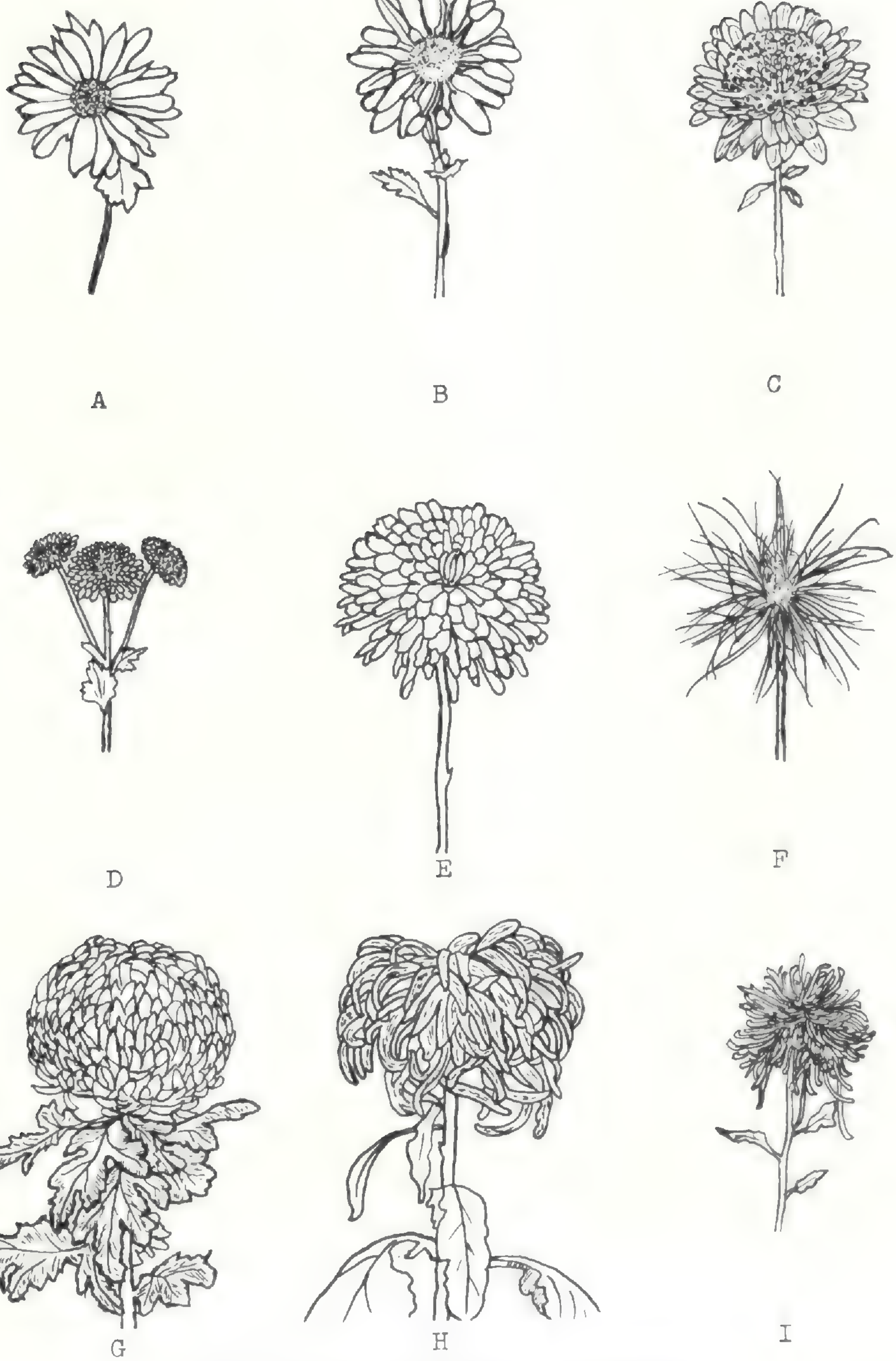
There is no definite record when the first chrysanthemums were grown in the United States but it must have been early in the nineteenth century. The first regular exhibition in America was held under the auspices of the Massachusetts Horticultural Society in 1868, but they, as well as the Pennsylvania Horticultural Society, had awarded prizes for chrysanthemums much earlier. This information is derived from *Cornell University Bulletin* 91, April, 1895, in which it is also stated that at first the chrysanthemums were treated as hardy plants and were cultivated in the outdoor gardens. Better flowers and plants were produced when they were afforded greenhouse protection. Apparently the chrysanthemum was not appreciated by the American people until 1888, when Mr. W. A. Manda, of Cambridge, Massachusetts, purchased the famous variety, "Mrs. Alpheus Hardy," from a Boston florist for the sum of $1,500, a price unprecedented in the chrysanthemum world. Mr. Michael Barker in *Cornell Bulletin* 91 says: "This event, and the subsequent advertising of the variety, did more to render the chrysanthemum an object of public fame in America than all other previous efforts combined." In the early years many of the imported plants proved to be unsatisfactory, and a number of leading growers began breeding

CHRYSANTHEMUM INDICUM

CHRYSANTHEMUM MORIFOLIUM (SINENSE)

new varieties. It is interesting to find that some of these pioneer firms are still familiar names in the horticultural world. Among them are Manda of New Jersey, Smith of Adrian, Michigan, Henderson of New York, E. G. Hill of Richmond, Indiana, Vaughan of Chicago, and Dorner of Lafayette, Indiana. In 1893 the Henry Shaw medal was awarded to J. Dorner and Son for the seedling chrysanthemum "Major Bonnaffon," a variety which is still grown commercially. Thousands of varieties of chrysanthemums are in existence throughout the world of which American growers list about five hundred in their catalogs.

When we say "chrysanthemum" we usually mean the plant that blooms in October and November, but there are other garden plants that are species of chrysanthemums, for example, the pyrethrums, marguerites and shasta daisies. The flowers of the fall-blooming chrysanthemum occur in so many colors and shapes that it is hard to realize that they all belong in one group. We know this to be a fact when we overhear conversations of visitors when they first enter the Floral Display House. As many people know only the large ball-shaped chrysanthemums they are unwilling to believe that every flower displayed is a chrysanthemum whether it be a small single or a large double variety. "Those plants in the hanging baskets are certainly not chrysanthemums," says the skeptic—but they are. A little closer examination should convince any one that there is a similarity in leaf structure even though there is a vast difference in the size and shape of the flowers. There are small and large single flowers consisting of one or two rows of petals and a prominent central disk; there are many double forms with the petals loosely arranged or neatly packed together in a globular arrangement, which are termed "pompons." Those with a distinct cushion of tubular flowers surrounded by one or several rows of ray florets of the same or contrasting colors are the "anemone-flowered" varieties. Also many variations occur from the three types just mentioned, some having thread-like, quilled, tubular, spatulate, or plume-like petals. In the large-flowered section there are varieties with very regular incurved petals known as the "incurved type"; others with loosely arranged irregularly shaped petals, which are called the "Japanese incurved or reflexed" chrysanthemums; and still others with hairy petals.



TYPES OF CHRYSANTHEMUM FLOWERS

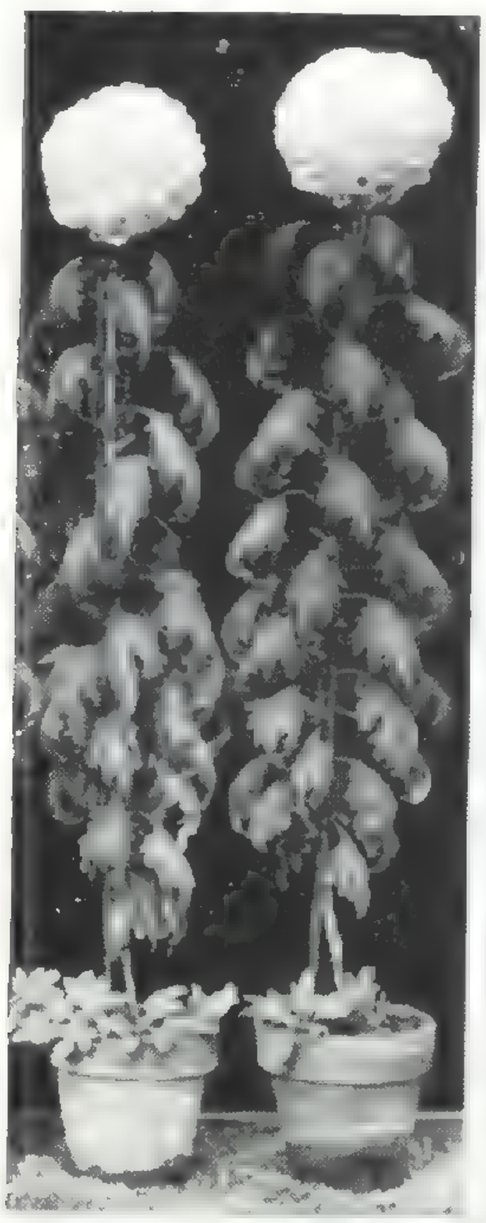
A—Single; B—Spatulate; C—Anemone; D—Button Pompon; E—Large Pompon; F—Spider; G—Incurved; H—Reflexed; I—Japanese Needle Quilled.

Chrysanthemums have been cultivated for so long that probably it will never be known how all of the present-day varieties originated. Since they are of hybrid origin individual plants sometimes produce branches with flowers of entirely different color from the original. When such a break in color occurs it is termed a "sport." If it is possible to preserve this color in succeeding plants, by means of cuttings taken from the odd-colored branch, a new chrysanthemum is secured, and if it is superior to existing varieties it is named and introduced to the trade. Many new varieties are also produced by hybridization. The "sporting" of the hanging-basket variety "Anna" was described in the December, 1935, BULLETIN.

The modern chrysanthemum is grouped into various classes according to the method of training, and this is governed by the kind of flower produced. For instance, varieties that bear very large double flowers are grown as "single stems," i. e., the plants are trained to only one flower. Now, by pinching a single-stem variety, a bush plant with many flowers could be induced to form. The flowers would be fairly large but probably too heavy to remain upright unless staked. Therefore, single-stem varieties are better grown to only one flower. There are many varieties of bush chrysanthemums; some are dwarf and others grow quite tall; some branch naturally but others must be induced to branch by careful pinching. The term "standard" is applied to large-flowered varieties that are trained to form a stem a foot or more high and then, by pinching, induced to produce several to many stems with large flowers. A "specimen" plant is usually quite large and needs a wire frame to support numerous shoots. Small- or large-flowered varieties are used in this type of training.

CHRYSANTHEMUM EXHIBITS

It is an interesting fact, when comparing attendance records, to find that more people visit the Garden in November than in any other month of the year. This fall will mark the thirty-fifth annual chrysanthemum show at the Garden. As far back as 1891 chrysanthemums were displayed in the old Exposition Building, located on the present site of the Central Library. In the closing years of the last century chrysanthemums were displayed in some



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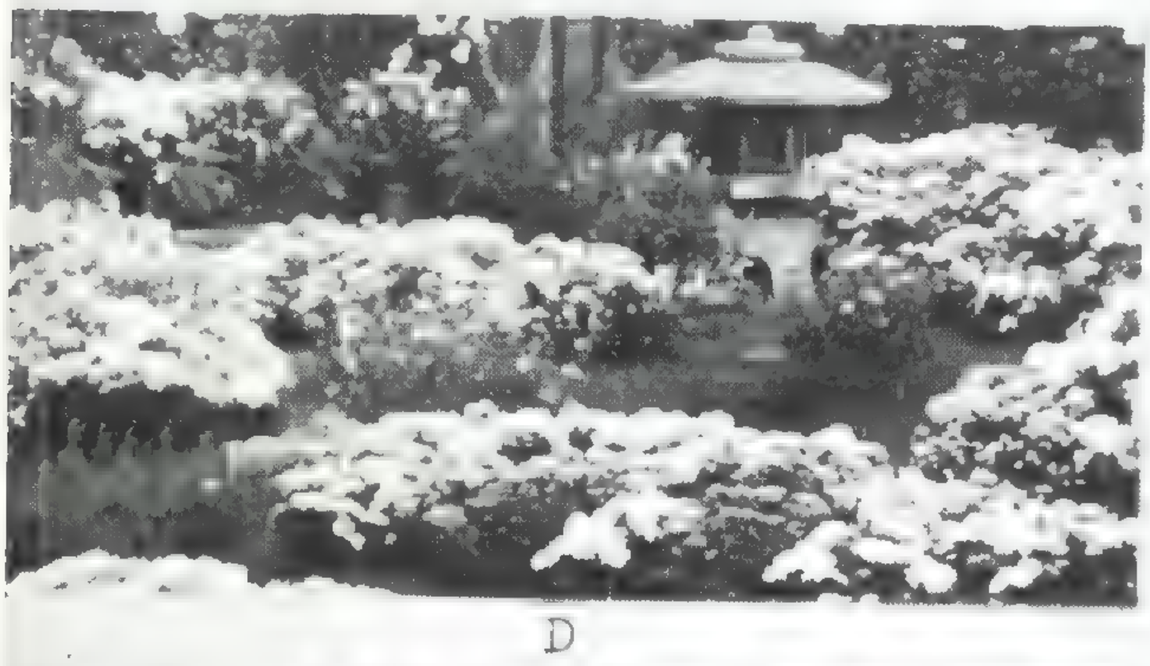

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METHODS OF TRAINING CHRYSANTHEMUMS

A—Single stem; B—Hanging basket; C—Standard; D—Bush; E—Specimen; F—Cascade.

of the Garden greenhouses but not as a complete exhibit. In 1904 many chrysanthemums were shown at the St. Louis World's Fair, and the following year marked the beginning of the present series of displays which have been held uninterruptedly up to the present year. We must make one exception and that was in 1911. The display had been assembled under a tent, as in the previous six years, but the night before the opening a severe storm leveled the tent and froze the plants. In 1912, although the new conservatory was still in the process of erection, it was possible to exhibit the chrysanthemums in the north wing. The next two shows were held in this new conservatory, and in the fall of 1915 the present Floral Display House was completed and opened with the chrysanthemum show.

About ten years ago the method of staging chrysanthemums was changed considerably, and since that time some suitable arrangement has been provided for each display. Instead simply of grouping the various types of chrysanthemums, they are now displayed against a rush background. Sometimes the design is formal, and sometimes the plants are placed in a natural setting. Accessories, such as bamboo fences, Tori and moon gates, stone lanterns, pools and tea houses, are frequently added to create the Oriental atmosphere associated with the chrysanthemum. This show is the largest and most colorful display of the year, but few people realize what a great amount of work is involved in preparing for it. The plants are carefully grown from seven to nine months before the show during which time they pass through various stages of development. This means daily care in the matter of watering, repotting, fertilizing, pinching, staking, and spraying. Numerous insect pests, such as leaf rollers, caterpillars, grasshoppers, aphids, thrips, mealy bugs, tarnished plant bugs and red spiders, harass the grower. Many of the bush chrysanthemums are grown in the field, and these must be potted in late August. By September nine growing houses are filled with chrysanthemums which need constant watering, spraying, staking, tying and disbudding.

In 1920 the Garden first displayed chrysanthemums in large hanging baskets. Plants with pliable stems were selected for this purpose, and after years of selection and training the suitable

CONSTRUCTING THE 1938 CHRYSANTHEMUM SHOW

THE CHRYSANTHEMUM SHOW, COMPLETED

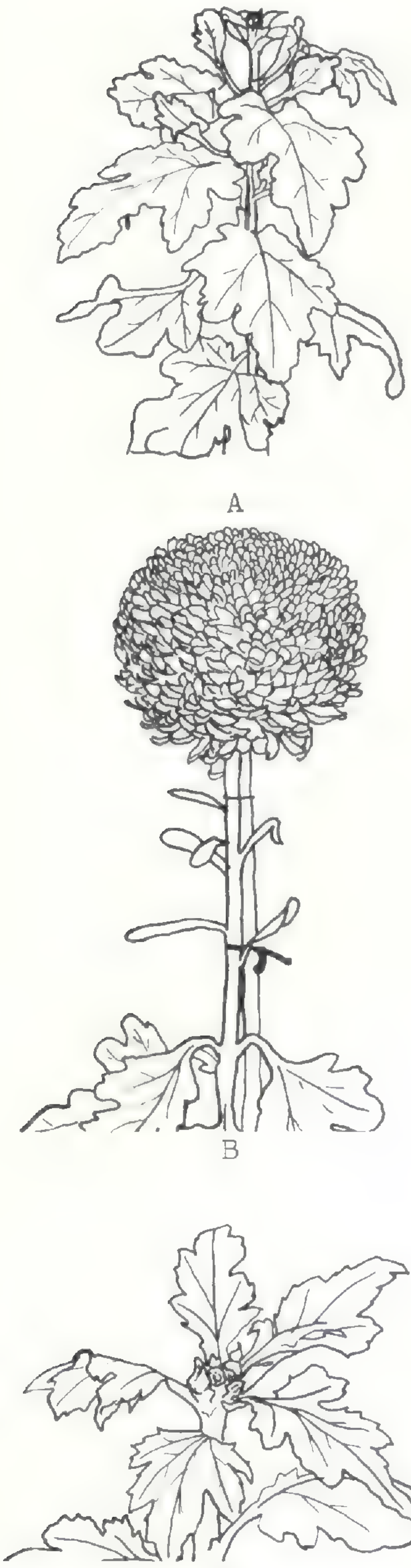
varieties have been narrowed to three—"Anna," single white, "Jane Harte," single yellow, and "Sam Caswell," double pink. By using only these three, plants are had that remain in bloom a long time and that do not have to be replaced during the show. Formerly, we used varieties such as "Adele Wallner," "Cosmos," "Yellow Daisy," and *Chrysanthemum indicum,* but none of these remained in bloom throughout the month of November.

In January, 1930, K. Yashiroda, Kagawaken, Japan, described the "cascade" method of training chrysanthemums in the English *Gardeners' Chronicle.* In the following November the Garden exhibited for the first time chrysanthemums trained in this novel manner. They have become very popular, and each year a group of them is featured in some part of the display. The growing and training of hanging baskets and cascades were fully described in the December, 1930, BULLETIN.

CHRYSANTHEMUMS FOR THE AMATEUR

Early-flowering varieties of chrysanthemums can be grown outdoors and brought into bloom under a cloth shelter on the south side of a building. This topic was fully discussed in the December, 1929, BULLETIN, but the important cultural points are repeated here. Since all chrysanthemums can endure a considerable amount of cold it is possible to winter the stock plants outdoors in a cold-frame. Freezing can be prevented if the frames are covered with mats and boards when the temperature is extremely low. Since the electric hot-bed cable has come into use frost can easily be excluded from any frame. The simplest way to start growing chrysanthemums is to purchase small 2½-inch pot plants in April or May. When necessary these are transferred to 4-inch pots and before the end of June are reset into 6-inch pots. During the summer the pots are plunged half their depth in a well-drained part of the garden. The bush varieties can weather windstorms, but the tall varieties need to be staked with bamboo canes which are tied to a wire support.

The large-flowered single-stem varieties are trained to one or several shoots each of which will bear a single flower. Plants that are to have more than one flower should be pinched when they are about six inches high. The number of laterals that are per-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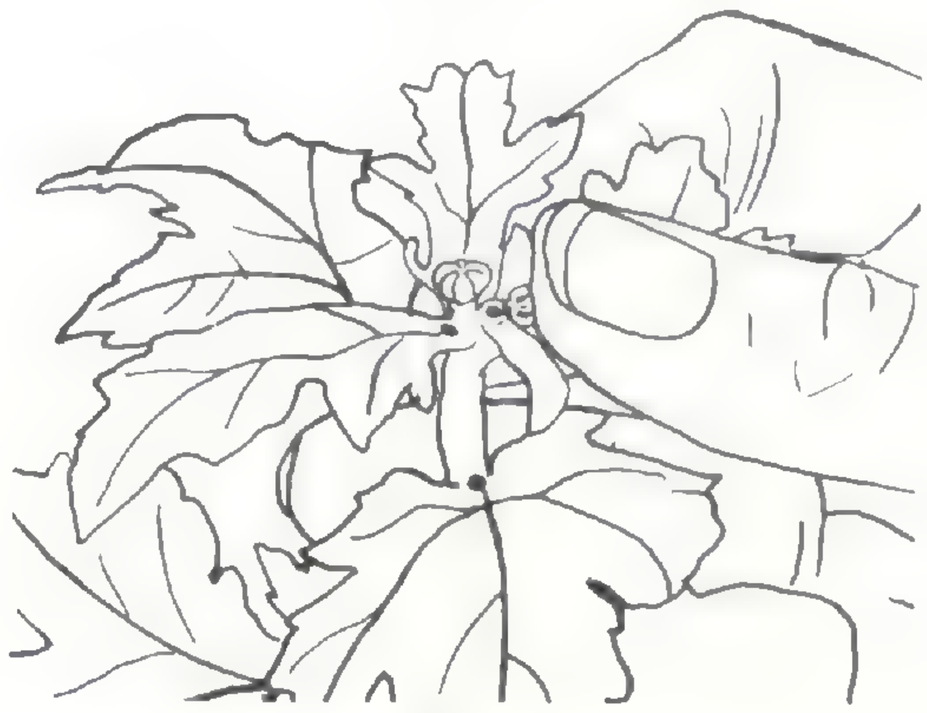
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SELECTING CHRYSANTHEMUM BUDS

A—Crown bud; B—Flower from crown bud, compact but sometimes without foliage; C—Terminal bud; D—Flower from terminal bud; E—Cluster of buds surrounding terminal bud; F—Disbudding, keeping the best bud.

mitted to grow is a matter of personal choice but it must be remembered that the more flowers per plant the smaller the flowers. During July and August numerous laterals will develop along the stems. These should be removed except two or three at the tip which are to replace the leader if it is injured. The first flower buds, termed "crown buds," are surrounded by several lateral shoots. If the crown bud is removed, one of the lateral shoots will form a "terminal bud" a few weeks later. This bud is easily recognized because it is surrounded by numerous small flower buds which must be removed as soon as possible. These explanations are probably very confusing but after growing chrysanthemums for a year they will be more intelligible.

After the middle of August the plants are fed with one of the commercial fertilizers, at the rate of one teaspoonful of a complete fertilizer to each 6-inch pot. Feeding is repeated at two-week intervals, the last application being made at the end of September.

Before frost occurs, in October, the plants must be moved to some sheltered location where they can be protected with cloth-covered frames. Here they are kept until in bloom when they may be moved to any location. After the plants are through blooming the stems are cut about two inches above the pot. The root systems, which are the stock plants for the following year, are kept in a cold-frame during the winter. They must be watered when dry, but this is seldom necessary in the dead of winter. Aphis and possibly thrip will attack the plants, but an occasional spraying with nicotine will control these pests. The stock plants produce numerous sprouts which are trimmed into 2½-inch cuttings in March or April. These are inserted in pots of sand, firmed, watered, and shaded during the day. After three weeks the cuttings will be rooted and ready for potting into 2½-inch pots. They are then grown on as previously described.

Bush plants are treated in the same manner as the single-stem varieties. Instead of training them to only a few stems numerous branches are forced to develop by repeated pinching unless the variety branches naturally. It is advisable for the amateur to grow bush plants before attempting single-stem varieties.

KOREAN CHRYSANTHEMUM "PYGMY GOLD"

KOREAN CHRYSANTHEMUM "MERCURY"

HARDY CHRYSANTHEMUMS

Any one interested in gardens has at one time or another seen some bedraggled chrysanthemums braving the cold in October and November and feebly lifting their flowers on long ungainly stems for a last splash of color. It has been the hope of gardeners that some day there would be varieties that would bloom before the first killing frosts. This desire is now being realized in the many excellent early varieties that have been developed in recent years. More than twenty years ago the United States Department of Agriculture took two varieties of chrysanthemums that had stood for years in old gardens of western New York and the earliest varieties from this country and England and grew them in the experimental farm at Arlington, Virginia. Thousands of seedlings were grown from natural crosses from these varieties, and in 1937 twelve promising seedlings were introduced to the trade. These twelve are described in the *U. S. Department of Agriculture Circular,* No. 528, May, 1939, by Dr. Mulford, and eight of these we will have in bloom in the Garden this fall. In addition, we have been growing numerous Korean chrysanthemums which have been developed by Mr. Alex Cumming, of Bristol, Connecticut, and the Henry A. Dreer Company, of Philadelphia. Mr. Cumming is the author of the current book *Hardy Chrysanthemums.* Besides the above-mentioned trial varieties we have for many years been growing standard early-flowering kinds.

The degree of hardiness of chrysanthemums is variable in the garden and in different parts of the country. There doubtless is a direct relationship between moisture and winter injury. Plants that grow in well-drained soil can endure lower temperatures than those growing in wet soil. Most of the chrysanthemums will survive the winter weather without a mulch. As a precaution, however, it is a safe plan in November to dig a clump or two of the choice varieties and store them in a cold-frame protected with sash or glass wool. From one year's experience with glass wool we feel confident this will make an excellent mulching material. Whatever type of covering is used it should not be applied too early. About the end of November is the proper time, and the mulch should be left on the plants until late March.

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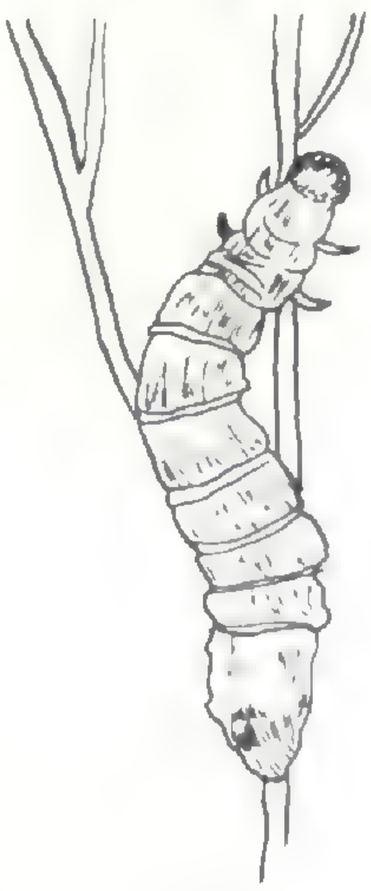

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SOME INSECT PESTS OF THE CHRYSANTHEMUM

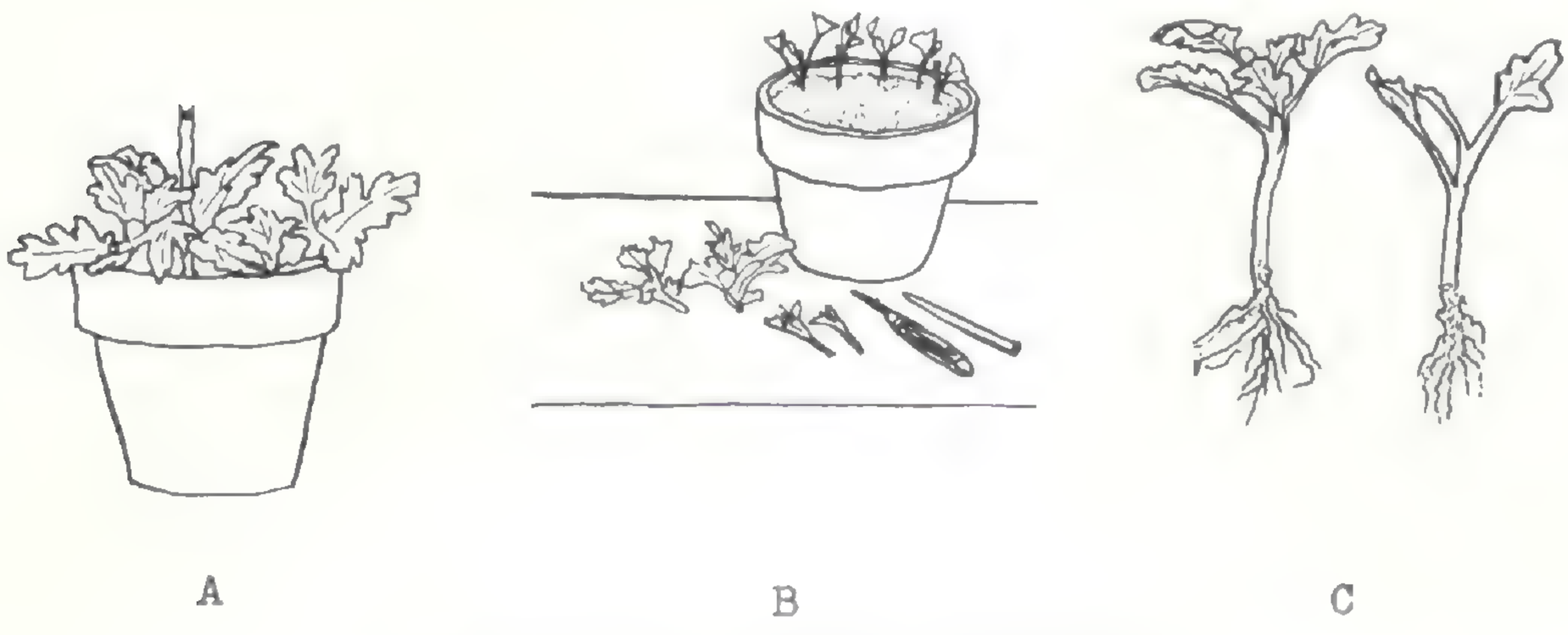
A—Aphis; B—Tarnished plant bug (enlarged); C—Blind growth caused by tar nished plant bug; D—Spittle on chrysanthemum; E—Spittle bug; F—12-spotted cucumber beetle; G—Greenhouse leaf tyer; H—Cabbage looper (enlarged); I—Cutworm (reduced).

Named varieties of chrysanthemums may be purchased in the spring and planted in the garden in May and June. Good soil, plenty of moisture, and room to spread are essential to growth. In June and July, when the chrysanthemums are growing rapidly, they should be "pinched" at ten-day intervals to induce branching. By "pinching" we mean removing the growing tip when the branches are four to six inches long. Pinching back to firm wood is not a good practice because this wood seldom produces laterals. Hardy chrysanthemums should not be pinched after July as it delays blooming and may cause blind growths. Properly pinched plants do not need staking unless they are unusually tall or the soil is softened by excessive rains as has been the case this August. Plants should be fed several times during the summer with any of the standard commercial fertilizers, using about two tablespoonfuls per plant. Over-fertilization may also cause blindness, so feeding should not be continued after the end of August.

Sucking insects are controlled with contact sprays, chewing insects with arsenate of lead, and leaf diseases, with Bordeaux mixture or powdered sulphur. One of the most difficult insects to fight is the root aphis, because associated with it are the ants which move the aphis from one plant to another. Stirring tobacco dust into the soil helps, but it is our experience that plants weakened by the root aphis seldom fully recover. If there are many chrysanthemums in an area where one or several plants are turning yellow the better plan is to destroy the weak plants. If, upon examination of the upturned roots, aphis are found, Cyanogas powder should be stirred into the infested area. Spittle bug sometimes attacks the tips of the branches, but is readily controlled with a nicotine spray. The most troublesome insects are the tarnished plant bug and the 12-spotted cucumber beetle. The tarnished plant bug stings the very tip of the branches, and in so doing injects a poison which stunts the growth. This is the place where the flower buds are formed and if once injured normal flowers will not develop. This insect appears to be present in greater numbers in the city than in the county gardens. It is most difficult to fight because of its habit of flying away as soon as disturbed. The spotted cucumber beetle feeds voraciously on the

chrysanthemum petals in the fall, and in bad years it literally shreds the flowers of the light-colored varieties. Arsenate of lead would be the logical stomach poison to use, but the beetle feeds only on the petals and since new buds are constantly opening it is impossible to keep all of them coated. One remedy is to hold a shallow pan of water, to which has been added a little kerosene or gasoline, under the infested plants in the early morning when the insects are still numb with cold. Since they have the habit of dropping from the plants when disturbed many of them can be brushed into the pan where they are immediately killed by the oil. Spraying the plants with a strong nicotine solution early in the morning will also burn many of them.

The chrysanthemums should be cut down to about six inches before they are mulched in late November or early December. Mulch with oak leaves, straw, ornamental grasses, or the new glass wool, but do not smother the plants with too heavy a covering.



A B C

PROPAGATING CHRYSANTHEMUMS

A—Stock plant; B—Pot of sand, knife and dibble. Cuttings trimmed and inserted in sand; C—Rooted cuttings.

In the following April the strong-growing varieties should be lifted, the roots separated, and small pieces with one to three shoots replanted. Slower-growing varieties may be left undisturbed for two or three years but not more than three shoots should be allowed to grow. The shoots should be pinched in the same manner as the pot-grown plants. Another way to increase hardy chrysanthemums is to cut the suckers in March or April and insert them in pots or boxes of sand in the cold-frame or in

any convenient place shielded from wind and sun. After three weeks the cuttings will be rooted, at which time they should be potted into 2½-inch pots. Later these plants are transferred to the garden, and in one season will make better-shaped plants than those left undisturbed for several years.

Korean chrysanthemums are very easily grown from seed which germinates freely. Plants started in March or April will equal any of the named varieties in size. The colors will be mixed but many of them will be similar to the named varieties. Once the plants are growing they are given the same culture as the vegetatively propagated varieties. P. A. K.

NOTES

Dr. David C. Fairburn, Horticulturist to the Garden, spoke before the Ferguson Garden Club, at Ferguson, Mo., September 21, on "Bulbs."

Dr. George T. Moore, Director of the Garden, gave a talk to the Hawthorn Garden Club of Jefferson City, Mo., September 25.

Mr. L. P. Jensen, Manager of the Garden Arboretum, spoke before the Garden Club of Washington, Mo., September 7, on "The Activities of Garden Clubs in the Conservation of Native Plants."

Recent visitors to the Garden include Mr. Robert Pyle, rose grower, of Conard-Pyle Co., West Grove, Pa.; Dr. Selden R. Warner, professor of botany, Sam Houston Teachers College, Huntsville, Tex.; Mr. E. Walther, member of California Academy of Sciences, and assistant superintendent of Golden Gate Park.

The September number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN (Vol. 26, No. 3), containing Dr. E. S. Reynolds' paper on "Tree Temperatures and Thermostasy," has been issued recently.

Mr. Russell J. Seibert, graduate student at the Garden, spoke at the Shiloh Valley Grange, Belleville, Ill., September 16, on "Plant Collecting in Panama"; and before the Mascoutah

Women's Club, Mascoutah, Ill., September 20, on "The Romance of Panama."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated talk "Along the Cactus Trail," before the Holy Name Society of St. Pius' Church, September 12; and before the Chicago Cactus Society, at Chicago, Ill., September 24, on "The Culture of Succulents."

Mr. George H. Pring, Superintendent of the Garden, gave a talk before the Ladies' Coterie of Granite City, Ill., September 21, on "The Missouri Botanical Garden Arboretum." On October 3, he was interviewed over Radio Station KMOX, on "Orchids for the Veiled Prophet Queen's Bouquet."

Dr. Carroll W. Dodge, Mycologist to the Garden, served as a corresponding member of the section on Fungi and Fungous Diseases, of the Third International Congress for Microbiology, at New York, September 2-9, and on September 4, he read an invitation paper entitled "Some Effects of Carcinogenic Substances on *Saccharomyces ellipsoideus*."

The *Journal of the Cactus and Succulent Society of America*, September issue (**11:** 42-43), contains a paper by Mr. Ladislaus Cutak, in charge of Succulents at the Garden, entitled "Succulents for Winter Window Gardens and Terrariums," reprinted from the December, 1937, *Garden Gossip*. Another of Mr. Cutak's papers, "Along the Cactus Trail," from the July, 1939, *Gardener's Chronicle of America*, was reprinted in the August 25 number of *Southern Florist* (**47:** 8-9).

STATISTICAL INFORMATION FOR SEPTEMBER, 1939

GARDEN ATTENDANCE:

Total number of visitors	25,574

PLANT ACCESSIONS:

Total number of plants received as gifts	31

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	5
Total number of books and pamphlets donated	538

HERBARIUM ACCESSIONS:

By Exchange-

Ahlner, Sten—Plants of Sweden	15
Hasselrot, T. E.—Plants of Sweden and Norway	18
Narodni Museum—Botanicke oddel—Plants of Czechoslovakia	48
Rau, W.—*Regnellidium diphyllum* Lindman from Brazil	1
University of Iowa, by G. W. Martin—Plants from Iowa, Texas, and the American Tropics	63

By Gift—

Anderson, Edgar—Plants of Missouri and Michigan	72
Berry, E. C.—*Parthenium Hysterophorus* L. from Johnson Co., Missouri	1
Brenckle, J. F.—Plants of South Dakota and Montana	11
Brown, W. L.—Plants of West Virginia	4
Cummings, George B.—Plant of New Mexico	1
Hubricht, Leslie—Plants of the southeastern United States	292
Lundell, C. L.—Plants of Mexico	17
Martin, G. W.—Plants of Texas	8
Moss, Mrs. Marion Child—Plants of Venezuela	3
Petersen, Oscar—*Atriplex argentea* Nutt. from Missouri	1
von Schrenk, Hermann—Plant of Horticulture	1
Seibert, R. J.—Plants of Illinois	2
Seibert, R. J.—Bignoniaceae from the American Tropics	32
Smith, A. C.—*Chiodecton sanguineum* (Sw.) Vain. from Brazil-British Guiana Boundary	1

By Transfer-

Fairburn, D. C.—*Evonymus patens* Rehder from horticulture	1

By Field Work-

Allen, Paul H.—Plants of Costa Rica	113
Hubricht, Leslie—Plants of southeastern United States	57
Ownbey, Francis Marion—Plants of western United States about	1,000
Woodson, R. E., Jr.—Plants of Panama, collected by P. H. Allen, J. H. Permar, R. J. Seibert and R. E. Woodson, Jr., and others, estimated at	1,708
Total	3,470

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MISSOURI BOTANICAL GARDEN BULLETIN

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OF THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

VANDOPSIS LISSOCHILOIDES
(Crimson-and Yellow Orchid)

Missouri Botanical Garden Bulletin

Vol. XXVII NOVEMBER, 1939 No. 9

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. XIII

VANDOPSIS LISSOCHILOIDES

The crimson-and-yellow orchid, of which the Garden has three specimens, was displayed in the floral orchid alcoves during July and August. This "splendid thing," as Dr. Lindley called it, was discovered in the Dutch East Indies over one hundred years ago by Gaudichaud. Later it was sent by Cuming from the Philippines to England where it was flowered by Bateman in 1846. Lindley described it under the name *Vanda Batemanni*. It has been rechristened several times but now has come to be recognized as *Vandopsis lissochiloides*. Our oldest specimen was received from England in 1916, when it was about one foot high, with leaves nearly as long. Only now, when the plant is three feet high with leaves thirty inches in length and two inches broad, is it old enough and large enough to be well able to carry a flower spike extending two feet above the vegetative growth.

The flower spike, produced from the upper tier of leaves, possesses twenty-eight flowers, indescribably beautiful. From the front they are a rich golden yellow with dark crimson spots, somewhat resembling the appearance of a tiger's back. Viewed from the back they are a brilliant Cattleya mauve. The flowers are two and a half inches across and leathery in texture. From four to five weeks are required for all of them to open fully. Sepals and petals are one inch long and half an inch wide, strap-shaped, revolute, widening towards the tip. The lip is inconspicuous and odd in shape, saccate at the base, golden yellow shaded with

mauve towards the sides, terminating in a narrow elongated upturned crimson spur. The column is sessile, crimson, faintly spotted white towards the apex. The anther cap is yellow fused with white.

RENANTHERA STORIEI

Among the forty-six species of orchids sent to the Garden from the Philippines in June, 1931, by Governor-General Dwight F. Davis, were four plants of *Renanthera Storiei*. When received, they averaged two feet in height; now they are six to seven feet high. This year three plants flowered for the first time, the flowers persisting for over two months after opening.

In Curtis's "Botanical Magazine," 1897, Sir Joseph Dalton Hooker writes of *R. Storiei* as follows:

"This magnificent plant, though in every respect so much a finer species, differs less botanically from the well-known *R. coccinea*, Lour. (Tab. 2997, 2998), than would at first sight be supposed. The flowers are much larger, of far more vivid colouring, the dorsal sepals and petals broader, and the lateral sepals more undulate, with bright, velvety blood-red blotches, the side-lobes of the lip are larger, and the midlobe obtuse. The column and the pollinia with their gland and stipes are the same in both species.

"*Renanthera Storiei* is a native of the Philippine Islands, and was first described in 1880 by Reichenbach. The plate here given is from a magnificent plant which flowered at Burford Lodge, by Sir Trevor Lawrence, in June of last year, and which was kindly lent for the purpose of being figured, together with a sketch of the whole plant. There is a good specimen of it in the Royal Gardens, Kew, which has not flowered as yet.

"Description.—*Stem* ten to twelve feet high, as thick as a swan's quill. *Leaves* eight to ten inches long, from oblong to linear-oblong, alternate, distichous, fleshy, keeled, bright green, tip two-lobed. *Peduncle* a foot long, leaf-opposed, pale reddish brown. *Panicle* a foot long, and nearly as broad, pendulous; branches spreading, the lower many-flowered; bracts small, triangular, green; pedicels with the ovary rose-coloured, one and a half inches long. *Flowers* two and a half to three inches long from the tips of the dorsal to those of the lateral sepals. *Dorsal sepal* erect, linear, widened towards the obtuse tip, orange-red, mottled with crimson; lateral sepals pendulous, subrhomboidly or spathulately obovate, undulate, crimson with large blood-red blotches. *Petals* erecto-patent, subspathulately linear, obtuse, falcate, coloured like the dorsal sepal. *Lip* very small; side-lobes quadrately oblong, erect, blood-red, bases externally golden-yellow, internally streaked yellow and red; midlobe rather shorter than the side-lobes, ovate, obtuse, blood-red, with two oblong calli at the base; spur broadly conical, tip rounded."

G. H. P.

CALOCHORTUS

GROWING GLOBE TULIPS AND MARIPOSA LILIES IN MISSOURI

The species of the genus Calochortus, although including some of the most delightful of the North American representatives of the lily family, have never been very popular with flower growers in this part of the country. This has undoubtedly been due to the conditions encountered in their cultivation, much different from those to which they are naturally adapted. During the course of a scientific study of this genus, it was necessary to grow a large number of the different species in the vicinity of St. Louis, and a plan was worked out whereby natural conditions would be duplicated as nearly as possible. The results secured, while far from perfect, were very encouraging, and it is hoped that this success will lead others to attempt to grow these beautiful plants.

Almost all of the species of Calochortus grow natively on dry rocky hillsides or desert mesas in the West. There, these plants are usually subjected to full sunlight, and the soil is unusually well drained. Even in the case of a few species which grow in moister situations, the soil is perfectly dry for several months of the year. In an effort to duplicate these conditions, a lightly wooded, north-facing slope at the Garden Arboretum was selected for the plantation. A few small trees and overhanging branches were removed to allow more sunlight and to facilitate air movement. The soil, although somewhat sandy, was not enough so, as was later discovered. Many species grow in heavy soil, but they do not like mud.

To prevent damage by rodents, the bulbs were planted in baskets made from half-inch mesh hardware cloth. These measured 18 x 42 x 9 inches, and were designed to accommodate fifty bulbs each. The baskets were placed in trenches on top of a three-inch layer of crushed rock to insure drainage. A layer of peat one inch thick was put in the bottom of each basket, and the soil replaced.

Planting took place the first week in December, just before the ground froze. The bulbs were covered with from one to three inches of soil, depending on their size. The beds were then thickly

mulched with dead leaves, mainly to prevent damage from alternate freezing and thawing. When the young Calochortus leaves began to show above the ground in February the mulch was removed, and the area fenced to keep out rabbits, which are very fond of the young leaves.

The first flowers appeared late in April, and there was a continuous succession of the different sorts until the first of July. The earlier ones did very well, but after the trees became leafy, the area was too shady and too wet. Lily leaf-rot thrives under these conditions, and the later kinds did not do so well. Furthermore, the reduced sunlight caused the stems to grow tall and weak, and subject to heavy damage from rains.

LIST OF SPECIES FLOWERED[1]

Section I. Eucalochortus

Group 1. "Globe Tulips"

***Calochortus albus* Douglas
***Calochortus amabilis* Purdy
***Calochortus amoenus* Greene

Group 2. "Star Tulips" or "Cat's Ears"

***Calochortus apiculatus* Baker
Calochortus coeruleus (Kellogg) Watson
Calochortus elegans Pursh
Calochortus Lobbii Purdy
***Calochortus monophyllus* (Lindley) Lemaire (*C. Benthami* Baker)
***Calochortus Tolmiei* Hooker & Arnott (including *C. Maweanus* Leichtlin and its varieties)

Group 3. "Star Tulips"

**Calochortus nudus* Watson
**Calochortus umbellatus* Wood
***Calochortus uniflorus* Hooker & Arnott (*C. lilacinus* Kellogg)

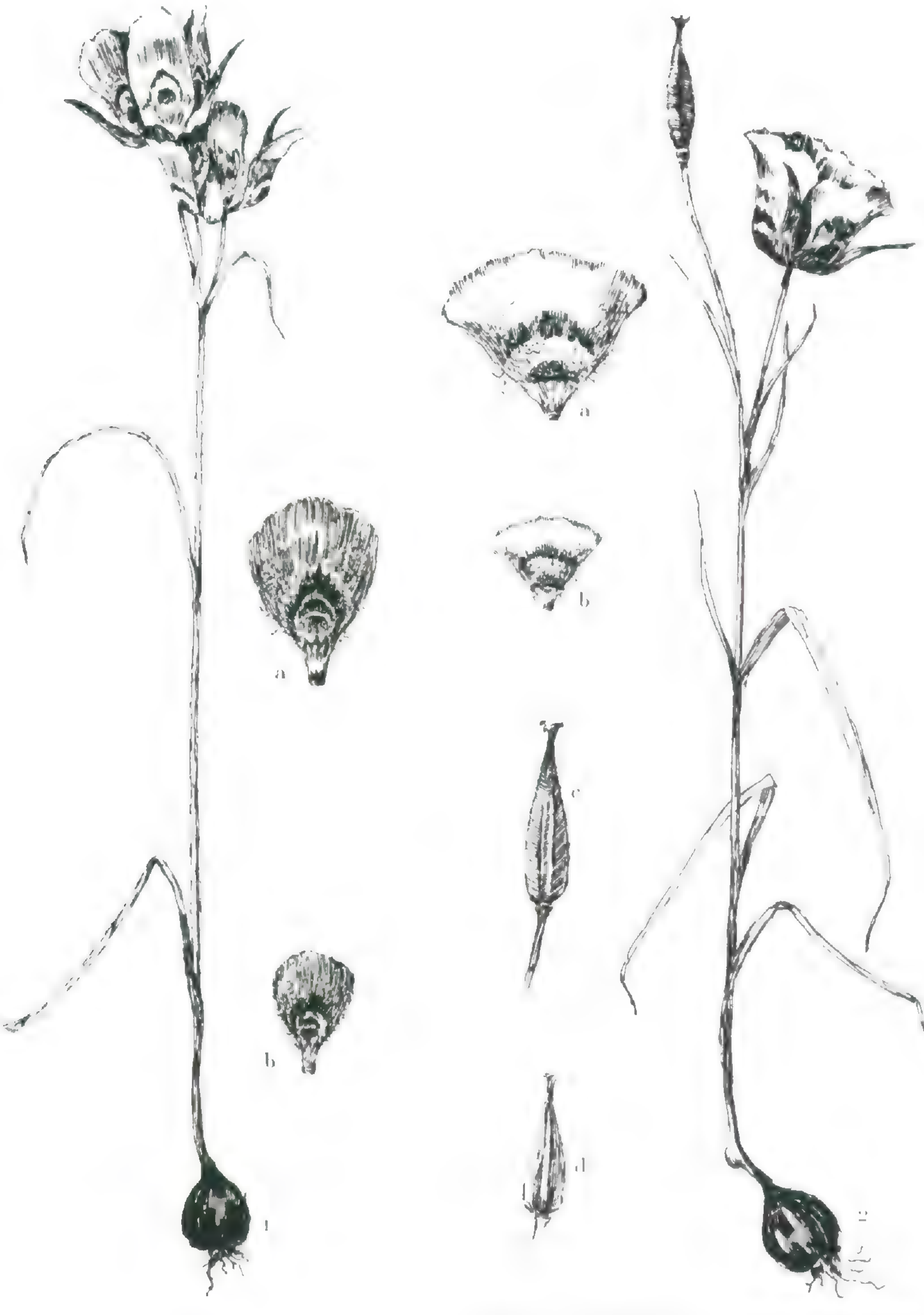
Group 4. "Oregon Mariposas"

***Calochortus Douglasianus* Schultes f. (*C. nitidus* Hort., not true *C. nitidus* Douglas)
*"*Calochortus Greenei*" Hort. (an undescribed species, not true *C. Greenei* Watson)
Calochortus Howellii Watson
Calochortus longebarbatus Watson
***Calochortus Lyallii* Baker
***Calochortus nitidus* Douglas (*C. eurycarpus* Watson)

[1]Species which did well are indicated with an asterisk (*); those which were particularly good and are recommended for further trial, by two asterisks (**).

(From Proceedings of the California Academy)

MARIPOSA TULIP
(Calochortus macrocarpus)



(From Proceedings of the California Academy)

MARIPOSA LILIES

1. *Calochortus longebarbatus.* 2. *Calochortus luteus.*

SECTION II. MARIPOSA. "Mariposa Tulips"

**Calochortus catalinae* Watson
**Calochortus clavatus* Watson
Calochortus Dunnii Purdy
**Calochortus Gunnisoni* Watson
Calochortus invenustus Greene
Calochortus Kennedyi Porter
Calochortus Leichtlinii Hooker f.
**Calochortus luteus* Douglas
Calochortus macrocarpus Douglas
**Calochortus Nuttallii* Torrey
Calochortus Palmeri Watson
**Calochortus splendens* Douglas
Calochortus striatus Parish
**Calochortus superbus* Purdy
**Calochortus venustus* Douglas
**Calochortus Vestae* Purdy

SECTION III. CYCLOBOTHRA. "Cyclobothra"

**Calochortus obispoensis* Lemmon
**Calochortus Plummerae* Greene
Calochortus Weedii Wood

After the tops had withered, the bulbs were dug, thoroughly dried in open air, and stored for the summer in paper bags in a dry place. This annual digging seems necessary, for, if left in the ground, the bulbs of most species decay before the next season.

From our experience, it would seem that many of the species of Calochortus can be successfully grown in the vicinity of St. Louis if care is taken to duplicate as nearly as possible the conditions of their native habitat. It is necessary, first of all, to be sure that the soil in which they are to be grown be perfectly drained. This may be accomplished by the selection of a naturally sandy slope, or by the addition of sand and gravel to ordinary garden soil, with provision for the escape of surplus water. If the water stands in puddles, or if the soil is sticky, even after heavy rains, drainage is not adequate. The problem of sunlight is also very important. In the West, certain species are quite tolerant to shade, but in Missouri it seems that all species do much better if subjected to full sunlight.

MARION OWNBEY and RUTH P. OWNBEY.

THE REDISCOVERY OF PRENANTHES CREPIDINEA

Thanks to the interest and the persistence of two readers of the BULLETIN, *Prenanthes crepidinea* has been rediscovered in Missouri. Among others whose attention was attracted by the short notice in the June BULLETIN were Bill Bauer and Oscar Petersen,

each of whom scoured a number of likely localities in an effort to locate this rare and nearly extinct species. In early August Mr. Bauer found it growing along Jack's Fork in Texas County, Missouri, and somewhat later Mr. Petersen located a few plants at Creve Coeur Lake, one of the spots at which it was formerly fairly abundant. In September Mr. Bauer and I found a single plant of it in Union County, Illinois, so that St. Louis botanists may be said to have reestablished direct contact with a plant which, from a purely scientific viewpoint, is one of the most interesting in this vicinity.

From any other viewpoint, the species is nothing to get excited about. In general appearance it is a rather coarse, weedy plant, growing waist high to shoulder high, and bearing in late summer yellowish-green flower heads which turn brown as the seeds ripen. Nor can the plant be said to be any more useful than it it is beautiful. Hogs apparently eat the root; at least the species disappears from woods which are extensively "hogged-over," but further than this, it is as generally useless a plant as one could find in a day's ramble.

One of the advantages of scientific study is that it can lend glamour to commonplace objects. The more one knows about the flora of the Ozarks, the more interested will he be in *Prenanthes crepidinea;* to one in possession of all the facts concerning it, this coarse and inconspicuous weed becomes so noteworthy that its rediscovery is positively exciting. To such a person it is a relic out of the long-distant past, which by a series of fortunate accidents has been preserved in a few places on the ancient plateaus of the central United States. In the northern hemisphere today there are a number of whole groups of species which trace their ancestry back to extinct plants very much like *P. crepidinea.* These are the hawkweeds (Crepis), the rattlesnakeweeds (Prenanthes), the wild lettuces (Lactuca), and other rarer genera. It is so similar to all of these that it could be grouped with any one of them, and actually has been so classified by one botanist or another.

Unless special steps are taken to protect *P. crepidinea,* it will probably not be many years before it joins the extinct reptiles with which it originally shared this planet. Unfortunately for it,

and for the few enthusiasts who take an interest in such plants, it is native to rich, well-drained soil. Most of the spots in which it grew have long since been put under cultivation. Many others have been so burned over or pastured that the native vegetation has been partially exterminated. Even Mr. Bauer, Mr. Petersen, and I have not seen more than twenty or thirty plants in all. There is all the more reason, therefore, that we should congratulate ourselves on having rediscovered one of the most ancient species of our native flora. E. A.

WINTER COURSES IN GARDENING FOR AMATEURS

ELEMENTARY COURSE

The elementary course in various phases of gardening for amateurs, which has been conducted at the Garden for the past few years, will be repeated in 1940. As formerly, it will commence in January, since it is believed that the course is of more value when given earlier in the year. The class will meet in the lecture room of the museum building (entrance at Tower Grove and Cleveland Avenue gate) at 3:45 p. m., Monday of each week.

REGISTRATION: It is desirable that registration be made by letter, with check enclosed payable to the Missouri Botanical Garden, as soon after December 20 as possible. Tickets will be ready for distribution on day of first lecture. Registration fees will also be received on January 8 at the lecture hall, at 3:00 o'clock.

FEE: The registration fee is $5.00 for each person, and tickets are not transferable.

The outline of the subjects to be discussed follows:

January 8—Discussion of catalogues, horticultural magazines and bulletins. Illustrated lecture on plant materials .....Kohl
January 15—Trees and shrubs:
Pruning of shrubs at planting time .....Beilmann
January 22—Annuals, perennials. Illustrated lecture .....Kohl
January 29—The general care of trees:
Surgery.
Fertilizers.
Cabling.
Transplanting .....Beilmann

February 5—Roses. Illustrated lecture .....Kohl
February 12—Lawns:
Seed lawns: Preparation of the soil, seed selection, fertilizers.
Stolon lawns: Methods of planting by means of stolons and plugging.
Lawns and their subsequent care .....Pring
February 19—Raising plants from seed. The students will sow seeds of annuals and perennials in the greenhouses, later transferring the plants to their own gardens. Students will furnish their own seeds .....Fairburn
February 26—Bulbs, iris and peonies. Illustrated lecture .....Kohl
March 4—Controlling insect pests. Material to use .....Beilmann
March 11—Water gardens. Illustrated lecture.
Construction of pools.
Preparation of soil and planting.
Caring for hardy and tropical water-lilies during growing season.
Propagation by seeds, tubers, leaves.
Breeding.
Winter storage .....Pring
March 18—The home culture of cacti and other succulent plants. Illustrated lecture:
Kinds for the beginner to grow.
Soil, air, light, temperature and moisture.
Propagation by seed, cuttings and grafting .....Cutak
March 25—The students will pot up the plants raised from seed sown Feb. 19. These plants will remain in the greenhouses until the weather permits the class members to set them out in their own gardens .....Fairburn

ADVANCED COURSE

The advanced course in gardening for amateurs will start February 7. The purpose of this course is to give the students as much practical garden work as possible. The classes will be held in the experimental greenhouses, Wednesdays and Fridays, 10:00 to 12:00 a. m. Due to the large enrollment it has been necessary to divided the class into two sections, one group meeting on Wednesday and the other on Friday. Students may elect either one of the two days to attend class. The course will be in charge of Dr. Fairburn.

Registration: The elementary course or previous gardening experience is a prerequisite to this advanced course.

Fee: The registration fee is $10.00 per student and tickets are not transferable. Write or phone the Garden for reservations.

February 7 and 9—The selection and care of house plants. How to force bulbs.

February 14 and 16--The preparation of fertile garden soil. Soil testing.
February 21 and 23—How to improve soils by the use of fertilizers.
February 28 and March 1—Identification and control of common garden insects and diseases.
March 6 and 8–April 3 and 5—Plant propagation. Five class periods will be devoted to this subject in order that the students may become familiar with a wide variety of plants and how to raise them from seeds and cuttings.
April 10 and 12—Potting of plants raised from seed.
April 17 and 19—Potting of plants raised from cuttings.
April 24 and 26—Landscaping the home grounds.
May 1 and 3—Garden work month by month. Survey of garden literature.
May 8 and 10—Trip to the Garden Arboretum at Gray Summit where the students will have an opportunity to see the large collection of orchids, the pinetum and many native plants.

NOTES

Dr. David C. Fairburn, Horticulturist to the Garden, gave a talk before the Webster Groves Garden Club, November 15, on "Bulbs."

Mr. A. P. Beilmann, Arboriculturist to the Garden, spoke before the Louisiana Garden Club, Louisiana, Mo., October 23, on "Trees and Their Care"; and before the Ladue Garden Club, November 7, on "Trees."

Dr. Juan E. Mackinnon, Assistant at the Instituto de Higiene Experimental, Seccion Parasitologia, Montevideo, Uruguay, is studying the cytology and variation of the *Monilia albicans* group of pathogenic yeasts, in the mycological laboratory at the Garden.

Mr. Paul A. Kohl, Floriculturist to the Garden, gave an illustrated lecture before the St. Louis Horticultural Society, October 6, on "Growing and Displaying Chrysanthemums"; and before the Musicians' Guild of St. Louis, October 6, on "A Trip Through the Missouri Botanical Garden."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated lecture before the Kiwanis and Rotary Clubs, of Edwardsville, Illinois, October 18, on "Exploring for Plants"; and at the dedication of the new cactus wing of the Irwin M. Krohn Conservatory, Eden Park, Cincinnati, Ohio, November 4, on "Cacti and Their Universal Appeal."

Mr. Ladislaus Cutak has had the following papers published recently: "Plant Life in the Shimmering White Sands," in the October number of *Desert Plant Life* (**11:** 145-147); "Desert Terrariums," in the October *Gardeners' Chronicle of America* (**43:** 317-318); and "Gardens in the Land of Dolly Madison," in the November *Gardeners' Chronicle of America* (**43:** 341-343, 350.)

Recent visitors to the Garden include Mr. Frank E. Atherton, orchid fancier, of Honolulu, H. I.; Mr. H. T. Hartmann, graduate student, Department of Horticulture, University of Missouri, Columbia; Dr. E. P. Killip, assistant curator, U. S. National Museum, Washington, D. C.; Mr. J. Myrlin McGuire, research assistant, University of Iowa, Iowa City; Dr. Hugh C. Cutler, botanical explorer in the Southwest; Dr. Esther Adams, teacher of biological sciences, Moberly Junior College, Moberly, Mo.; Dr. E. A. Cockefair, professor of botany, Central Missouri Teachers College, Warrensburg, Mo.

The fourth number of Volume XXVI of the ANNALS OF THE MISSOURI BOTANICAL GARDEN (November, 1939) has been issued, with the contents as follows: "New or Otherwise Noteworthy Apocynaceae of Tropical America. VII," Robert E. Woodson, Jr.; "Two New Asclepiads from the Western United States," Robert E. Woodson, Jr.; "Contributions toward a Flora of Panama. III," Robert E. Woodson, Jr., and R. J. Seibert; "The Genetic Coefficients of Specific Difference," Edgar Anderson and Ruth Peck Ownbey; "Morphogenetic Differences between *Nicotiana alata* and *N. Langsdorffii* as indicated by their Response to Indoleacetic Acid," Lillian Nagel; "Monograph of the North American Species of the Genus *Ephedra*," Hugh C. Cutler.

STATISTICAL INFORMATION FOR OCTOBER, 1939

GARDEN ATTENDANCE:

Total number of visitors	31,692

PLANT ACCESSIONS:

Total number of plants and seed-packets received as gifts	54

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	17
Total number of books and pamphlets donated	339

HERBARIUM ACCESSIONS:

By Exchange—	
New York Botanical Garden—*Scleroderma* sp. from Bermuda	1
Purer, Edith A.—Plants of California	10
By Gift—	
Anderson, Edgar—Plants of Michigan and Illinois	18
Correll, D. S.—Orchids from southeastern United States	68
Fisher, George L.—Plants of Texas	5
Harrison, Bertrand F.—Plants of Utah	133
Hubricht, Leslie—Plants of Missouri	6
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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXVII DECEMBER, 1939 No. 10

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

A MONSTROUS FORM OF THE SAGUARO

Missouri Botanical Garden Bulletin

Vol. XXVII DECEMBER, 1939 No. 10

SACRED TREE OF THE PAPAGO INDIANS

Some while back I saw a revival of the sparkling romance, "The Gay Desperado," which brought back memories of a camping trip in Arizona undertaken in the fall of 1935. The picture unfolds a story of a gay and glamorous Mexican bandido who sings his way out of a succession of difficulties, saving his own life and winning the girl by the magic of his voice. The locale of the story is Old Mexico, but actually the scenes were "shot" in the cactus country of southern Arizona, in the vicinity of San Xavier del Bac Mission.

As I followed the fast-moving scenes, especially those leading through groves of Brobdingnagian cacti, I had very little difficulty in recalling my treks through these same groves. Instead of gun-toting bandits, pretty girls and a host of other movie extras chasing back and forth across the desert, there were only the three of us, Dr. Shantz, Arthur Christ and I, driving, zigzagging and dodging the venerable giants that grow so profusely in the rocky valleys and foothills of this picturesque region.

The giant cactus, or saguaro, is the most curious vegetable growth in Arizona's landscape, and because it is so much in evidence there it is small wonder that Arizona has adopted it as the State flower. The plant reaches forty or fifty feet in height, two to four feet in diameter, and several tons in weight. It is only a few inches in height for many years, and by the time it is thirty years old its height has increased to about four feet. If conditions are ideal, from then on, the growth will average about four inches annually and will continue for about 150 to 200 years. The

saguaro reaches its maturity on its fiftieth birthday, as previous to this time it very seldom flowers or produces fruit.

The saguaro makes its greatest display on rocky eroded slopes, its tremendous bulk anchored lightly by its roots which lie only a few inches under the surface and spread laterally for many feet in all directions. The wickedly-armed trunk rises straight for ten or more feet before it sends forth numerous branches in candelabra-like form, each branch terminating in a dense cluster of waxy white flowers.

The giant cactus was not botanically described until ninety-one years ago, although it had been known to the early explorers and missionaries as early as 1604. Originally called *Cereus giganteus* by Engelmann, it later was made the type of a new monotypic genus by Britton and Rose and named *Carnegiea gigantea,* in honor of Andrew Carnegie, the great industrialist and philanthropist, through whose generosity the famous Carnegie Institution owes its existence.

The peaceful Papago Indians, who had always made their home in the region of the saguaro, consider the Carnegiea a sacred tree. It plays an extremely important part in the life of these desert dwellers, and the ripening season (usually early July) is the cause of merriment and the beginning of their New Year. The fruit constitutes the most important crop, and no other tribe of Indians is more dependent upon it than they. The harvest lasts about two weeks. Each family moves to its accustomed camp among the fluted giants where they build a shelter for the duration of the harvest season. It is up to the women to go out twice a day, visiting each cactus plant every three or four days to gather the crimson fruit as it ripens. Since the fruit appears only at the extreme tip of the arms or at the top of the tall stems it is knocked down with long slender poles into bowl-shaped, water-tight baskets.

The fruit pulp is soaked over night to remove the black seeds, then boiled. After the juice is drained off, it is reboiled to make a syrup, and finally placed in hermetically sealed jars. The remaining pulp is made into cactus jam. The seeds are likewise saved, parched, sun-dried, stored in sealed jars, and ground for flour as needed. Each Papago family usually puts up from three

THE SACRED TREES IN PAPAGO LAND

SILVER LACE-VINE, OR CHINA FLEECE-VINE (*Polygonum Auberti*)

to ten gallons of syrup and a smaller quantity of preserves. On the average about twenty-five to thirty pounds of fruit are required to make one gallon of syrup, so it can be seen that a very large quantity must be utilized by this tribe. An intoxicating beverage is also made from the boiled juice of saguaro fruits, but since it is impossible to keep for any length of time, it is usually consumed soon after fermenting. This beverage is brewed once a year with elaborate ceremony, during the saguaro season, and the brewing, drinking and intoxication are all considered a part of the ritual for bringing rain.

It is readily seen that the saguaro is an extremely useful plant to the Papagos. Not only food and drink are derived from it, but various minor disposals are made of its other parts. L. C.

SILVER LACE-VINE, OR CHINA FLEECE-VINE

When the gardener's summer day is done he wants to be relieved from the cares of the garden and just sit and rest. Perhaps his place of leisure is a veranda or vine-embowered trellis. But alas, his peace of mind is disturbed by the many fallen leaves of the wisteria, and why? Because under city conditions in a dry year red spider takes its toll, and to complete the destruction leaf rollers wrap up the remaining leaves. That well-earned hour of leisure is changed into an hour of work manning the syringe and spray-gun. On another evening the leisure hour is again disturbed by the demands of the climbing roses for protection against red spider, caterpillars and mildew.

And so it goes until finally the gardener in sheer desperation decides to cover his veranda with a vine free from all troubles, so that he may gaze through the leafy branches with the assurance that the vine will thrive without the nightly ministrations. His prayer is answered when he selects the silver lace-vine, *Polygonum Auberti*. This is a vine that will thrive under normal conditions of soil and moisture and is free from any insect pests or diseases. Young nursery-grown plants set out in spring will quickly become established and in a few years will cover large areas. In mild winters some of the stems will remain alive but

since growth is so very rapid it is just as well to cut them to the ground each spring. The silver lace-vine blooms for a long period in August and September, the vine being literally smothered with white buckwheat-like flowers. P. A. K.

AN OLD-FASHIONED ROSE

The rose collection of the Missouri Botanical Garden includes a number of old-fashioned kinds which have been kept on here long after they disappeared from most gardens because they fitted the peculiar demands of our exacting location. One of these Cinderellas is a charming little rose named, most inappropriately, "Coquette des Alpes." Although the flowers of this variety are not large, they are nicely formed and the color is clear, if not brilliant. The whole plant has a neat and graceful growth habit, neither too lusty for the edge of the perennial border nor too dainty for the

An old-fashioned rose (Coquette des Alpes)

shrub collection. The leaves are attractive and are borne with such grace that the variety is particularly desirable in making up old-fashioned mixed boquets.

According to Ellwanger, "Coquette des Alpes" was introduced in 1867 by Lacharme who produced it from "Blanche Lafite" and "Sapho." It is therefore one of those varieties which are properly classified as "Hybrid Noisettes" and which differ from their cousins, the Hybrid Perpetuals, by having in their ancestry a strain of the old-fashioned musk rose. "Coquette des Alpes" shows this influence very strongly in its smallish shell-pink flowers, its graceful shape, and in a musky undertone to its sweet perfume.

For the first fifteen or twenty years after its introduction this variety seems to have been popular and it is mentioned briefly in several English and American works written during the 1880's. As fashions changed it passed out of favor and no mention of it seems to have been made since 1890. Even the recent revival of interest in old-fashioned roses has not brought it to attention until now. Since our experience has shown that it is not only a charming little rose, but one which is adapted to our peculiar climate it may perhaps find a welcome in modern American gardens.

EDGAR ANDERSON.
JOHN S. LEHMANN.

THE CULTURE OF AFRICAN VIOLETS

No house plant in recent years seems to have created such a stir in amateur circles as the African violet. In fact it has become so popular and inspired so many inquiries regarding its growth requirements that we feel it is time to broadcast a few cultural suggestions.

In the first place, this plant is really not a violet by any stretch of the imagination. It is a member of the Gesneria Family, hence closely related to the Gloxinia, Streptocarpus and Achimenes. Its botanical name is *Saintpaulia ionantha*. However, the common name is quite applicable, since the plant is native to the tropics of Africa and the bright lavender-blue to lilac flowers, with a dash of golden yellow anthers at the centers, do resemble violets to some extent. Attractive dark green, fleshy leaves arise in rosettes

from a short central stalk or stem (fig. 1). The horticultural varieties, such as "Blue Boy," "Blue Boy Supreme," "Sailor Boy," "Admiral," "Amethyst," and "Viking" are vastly superior to the original type or true species.

When African violets are grown properly, they make a fine showing, the plants blooming almost continually throughout the year. Unfortunately, they are rather temperamental and many

Fig. 1. African violets are attractive house p'ants.

window gardeners fail to grow them to advantage. Here are a few reasons why African violets often come to grief in the house:

1. *Hot, dry atmosphere.* A cool temperature of 60-70° F. is favorable, and the moisture in the air can be increased by evaporating pans of water on radiators. A shallow metal tray containing moist gravel makes an excellent base on which to set potted plants.

2. *Wet leaves.* Since the leaves are decidedly hairy, they do not dry off quickly and the water may cause pale yellow spots and streaks on the foliage, especially if the plant is exposed to intense

sunlight. The best way is to water the plants by sub-irrigation, which simply means placing the pots in a basin of water until the soil is thoroughly soaked and then draining off the excess. This process should be repeated whenever the soil feels dry to the touch.

3. *Strong sunlight.* African violets do not flourish in strong sunlight, but they do appreciate the early-morning sunshine with plenty of indirect light the rest of the day. A window facing to the east is an ideal spot for them.

4. *Over-feeding.* Fertilizers should be used cautiously. These plants do not grow rapidly, and an over-dose of additional food may injure them severely. A safe way is to use about one teaspoonful of a complete fertilizer to a quart of water and apply this mixture as a regular watering, once every week or two.

5. *Mealy bugs.* Inspect the crown of the plant and the undersides of the leaves. If you see small patches of cottony material and small, white, oval-shaped insects creeping around, by all means remove them. These are mealy bugs and their egg masses. They have sucking mouth parts like a mosquito and soon devitalize a plant by extracting the cell sap.

6. *Soil.* If it becomes necessary to repot the plants, do not use a heavy clay soil. A mixture of equal parts of garden loam, sand, and peat or leaf-mold will produce far better results.

Growing African violets in terrariums, glass bowls and other types of "Wardian Cases" is one way to eliminate the possibility of injury from dry air in the average living room. Be careful, though, that the soil is not kept wet and soggy as the plants are apt to rot. It is also wise to keep the lid of the glass case raised a fraction of an inch to provide some air circulation. When exposed to direct sunlight, closed glass cases heat up rapidly, so always remove the lids or covers entirely and remember too much sunlight is just as injurious as not enough light.

Plants which are two or three years old may become rather straggly and weak. They should be replaced with young, vigorous specimens which are easily started from leaf cuttings at any time of the year. Simply cut several large, healthy, mature leaves from an old plant, leaving about two inches of the petiole (stem) attached. Mix up some moist sand and peat (equal parts) for a rooting medium. The leaves can be rooted in plain water, too,

but they get quite a set-back when transferred to soil later on. A flower-pot or small box will serve as a container for the sand-peat mixture. The leaf cuttings are inserted in the rooting medium as illustrated in fig. 2. Keep the sand-peat mixture moist at all times, but not saturated. The cuttings require about the same temperature and sunlight as the mature plants. A glass jar inverted over the leaves helps to keep them firm and healthy. It generally takes

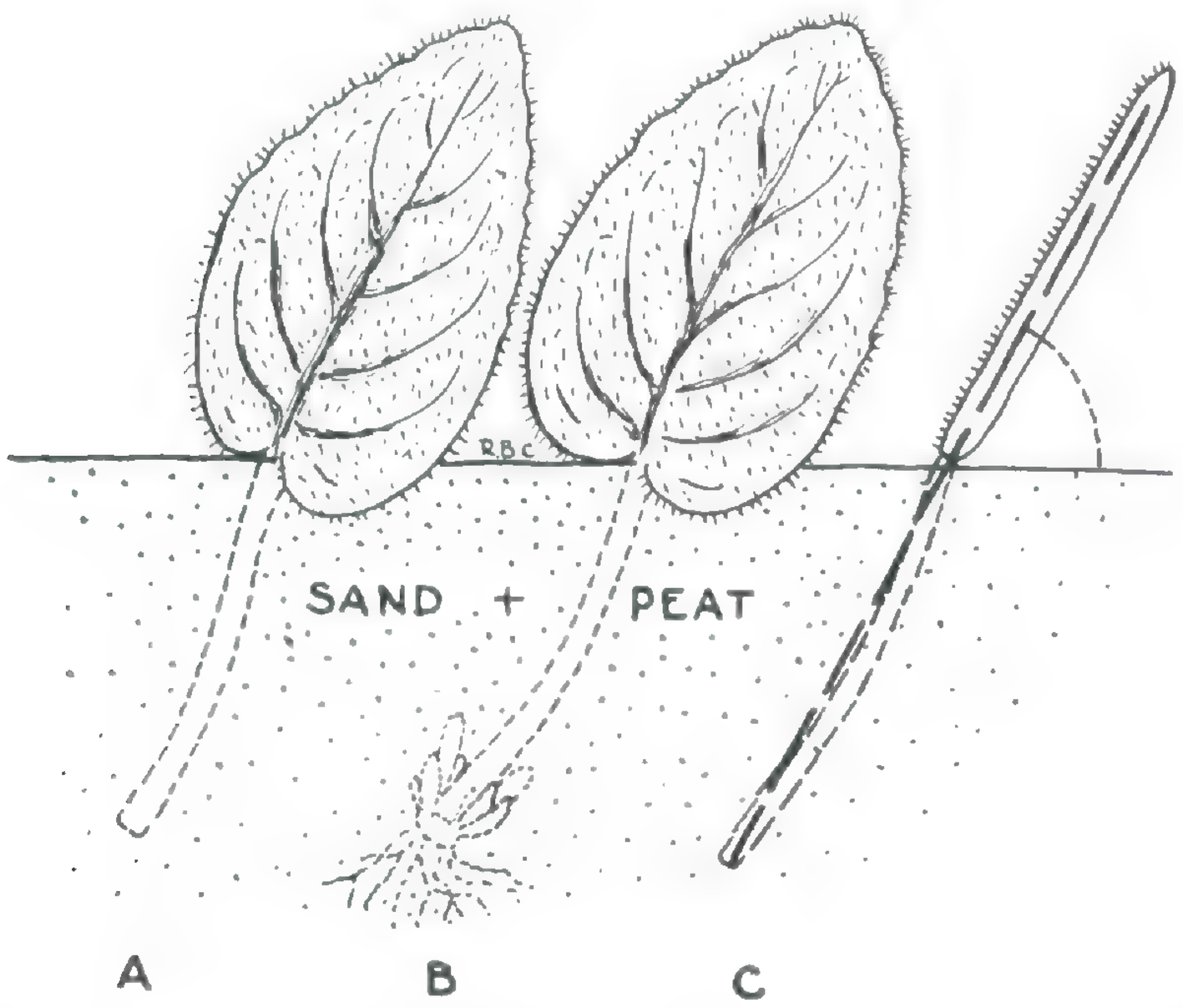


Fig. 2. A—Leaf cutting of African violet properly placed in the rooting medium; B—New growth arises from the basal end of the petiole; C—The leaves should be placed in the sand peat at a slight angle, the upper surface to the front.

the leaf cuttings six to eight weeks to form roots and the new sprouts may not push their way up to the surface until another three or four weeks have elapsed. In other words, it requires about three months to get a new plant well started from a leaf cutting. Treatments with root-forming chemicals do not speed up nor otherwise improve the rooting process. The young plants should be potted up in the soil mixture previously recommended for mature specimens.

In plant propagation the unexpected often happens, and so we stumbled upon something unusual in the development of young

plants from leaves of the African violets. In fig. 2B it will be noted that the new growth arises from the basal end of the leaf petiole or stem. This is normal behavior for the cuttings. In fig. 3 you will see young plants developing at the basal end of the leaf stem and also on the lower part of the leaf itself. We have propagated many hundreds of African violets and only two cuttings have produced plantlets directly on the leaf blade. In so far as I know

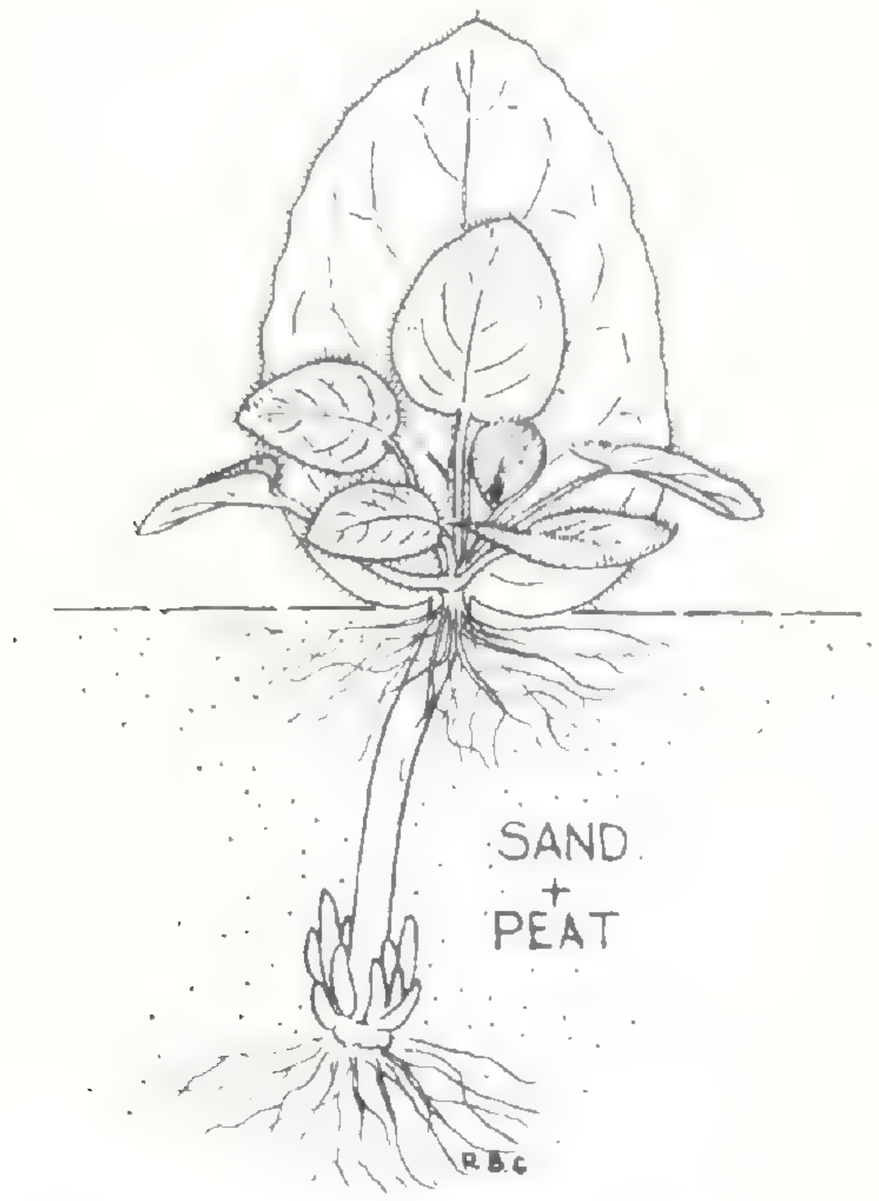


Fig. 3. Leaf cutting of African violet, showing a young plant developing directly on the blade of the leaf, as well as at the base of the petiole.

this viviparous characteristic of Saintpaulia has not been reported elsewhere. It occurred on cuttings taken from the variety "Sailor Boy," a fact which may or may not be incidental.

D. C. F.

IDENTIFICATION AND CONTROL OF COMMON PLANT PESTS

Of all the many horticultural questions sent in to the Garden, none is so familiar as, "My plants are buggy. What should I do

about it?" To answer such a question accurately, it is first necessary to know what kind of insect is causing the trouble or at least have some description of the injury to the plant. By segregating insects into three groups according to their feeding habits, the problem is at once considerably simplified.

1. *Chewing mouth parts.* Caterpillars and beetles actually eat the leaves bite by bite, so this type of injury is very easy to identify. Borers fall in this group, too, but they damage the plant by tunneling inside the roots and stems.

2. *Sucking mouth parts.* Aphids, mealy bugs, red spiders (mites), white fly, leaf hoppers, scale, etc., puncture the leaves and extract the juices. When leaves become distorted, lose their normal green color and get flecked or speckled a dull gray to yellow, it is likely to be the work of one or more kinds of sucking insects.

3. *Rasping and sucking mouth parts.* Thrips are in a class by themselves since they combine the good (?) features of groups 1 and 2. Their presence is indicated by silvery streaks or patches on the leaf, which are often most conspicuous near the veins on the underside.

During summer, insects in the flower garden can become a serious nuisance, but usually they spread themselves around over a number of plants and the damage is not so pronounced in any one spot. Then, too, natural controls such as predacious insects, birds, toads, snakes, disease and various parasites help keep them in check. But in the house it is a different story. Conditions are ideal for their rapid development, and with relatively few plants to attack it is soon "all over but the shouting" unless you eradicate them post-haste.

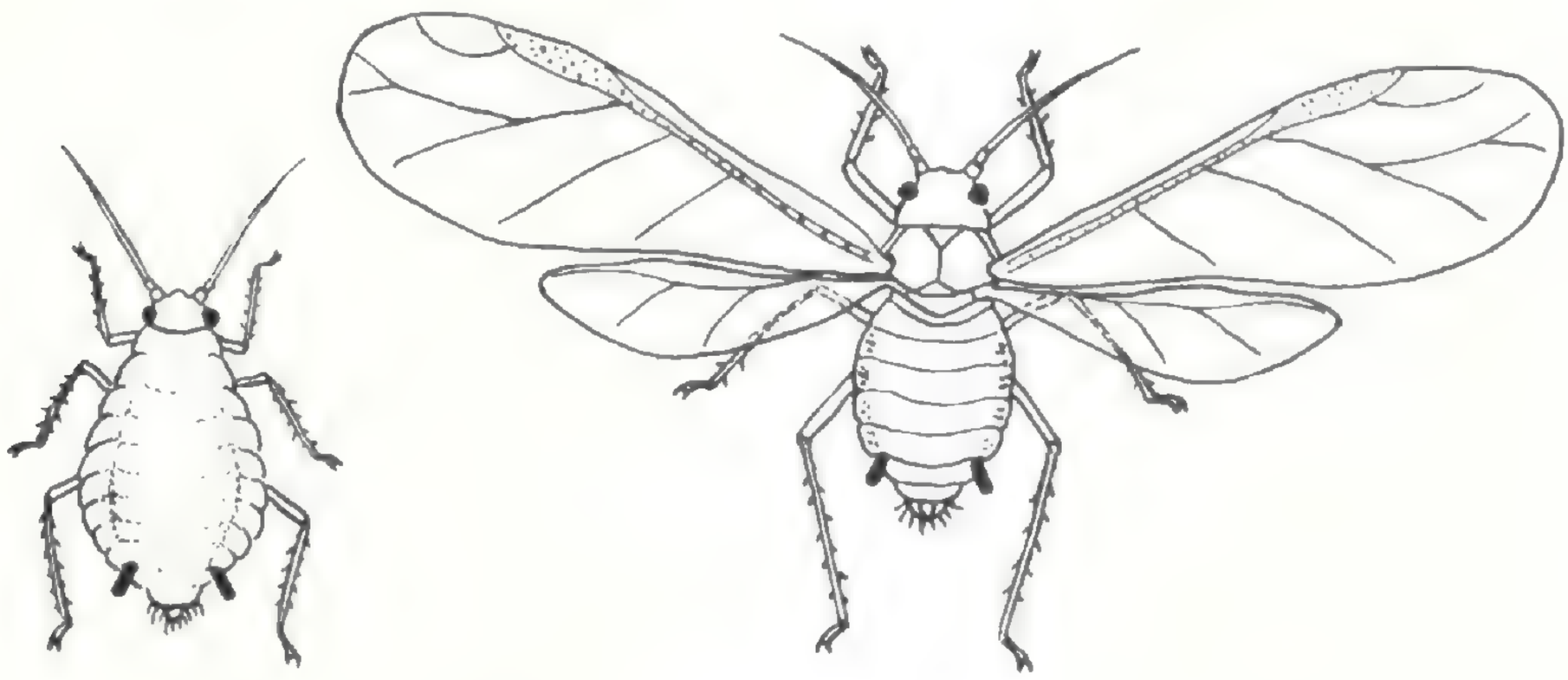
What we plan to do with this problem of pest control is to present it in a series of BULLETIN articles, discussing only one type of harmful insect each month. Amateurs will perhaps find it considerably easier to absorb the material in small doses, rather than trying to grasp the whole subject at one sitting.

PLANT PEST NO. 1—APHIDS

Indoor gardeners sooner or later come to realize that aphids are "just that way about plants," like fleas are about dogs. It is best

to assume a philosophical attitude and in the meantime keep the spray-gun handy. If you are using a definite color scheme in the living room, chances are it will be entirely possible to get aphids to match for they come in various tints and shades of green, greenish-yellow, pink, brown, red, and purple, as well as white and black with variegations. The common names of aphids are green fly, black fly, plant lice, ants' cows, and a number of other choice descriptive terms which can hardly be mentioned here.

Amateurs are becoming quite "aphid conscious," judging from the specimens brought into the Garden for identification. These



1 2

Fig. 1. Wingless aphid greatly enlarged. Fig. 2. Winged female greatly enlarged.

specimens range from June bugs to termites. Figures 1, 2 and 3 (adapted from U. S. Dept. Agr. bulletins) illustrate the general nature of aphids. They have soft, oval-shaped bodies about the size of a pin-head, conspicuous antennae (feelers) and long, slender, ungainly legs. The two short, black honey-tubes, or cornicles, which project from the abdomen near the posterior end, are a sure means of identification. Aphids have a piercing beak (like a mosquito) which they use to puncture the tender leaves, stems, buds, flowers and roots, extracting the cell sap in relatively large quantities and causing lack of vigor or completely ruining the plant. They are also credited with carrying various plant diseases, such as mosaic and blight. There are wingless and winged forms, the latter migrating to fresh plants and starting

new families. These insects multiply very rapidly, the females giving rise to living young parthenogenetically, and also by the egg method which is used to tide the tribe over winter in the garden. This egg stage explains the almost spontaneous generation of aphids. A supposedly clean plant is brought into the house and in practically no time it becomes "lousy." Only one tiny egg is required to start a new colony, the theme song of the agamic females apparently being something like, "I get along without you very well."

Ants are generally found scurrying around plants infested with aphids; consequently they are often credited with all the damage. What they are really after is the honey-dew secreted by the aphids, hence the common name "ants' cows." One hears tales about ants lugging aphids from plant to plant so the pastures will always be green and the supply of honey-dew abundant, but I have never seen this clever "back-scratching" act in operation. To get rid of the ants, simply destroy the aphids.

Control measures.—Most insects can be easily controlled by putting the infested plants in the kitchen sink and applying a forceful spray of water to both sides of the leaves, stems, flowers, etc. This operation should be repeated whenever the pests reappear.

The standard remedy for aphids is 40 per cent nicotine sulphate or solutions containing 40 per cent free nicotine. These spray materials are sold under various trade names, as, for example, "Black leaf 40," "Nikoteen" and "Nicofume." They are contact sprays, that is, the insects are killed when the liquid touches them. The nicotine fumes also kill them. Stomach poisons, such as arsenate of lead, applied to the surface of the leaves, have no ill effect on aphids as they do not eat the foliage. An inexpensive hand spray-gun is all the equipment needed, and be sure to spray both the upper and lower surfaces of the leaves. Use the insecticide according to directions on the bottle or container. About ½ teaspoonful of the spray liquid to a quart of water, plus a few soap flakes to act as a spreader, will kill aphids in a hurry. The treatment may have to be repeated occasionally to keep the plants free of these persistent visitors. Nicotine dust and pyrethrum extracts are also effective bouncers. Do not use nicotine on violets

as it injures the foliage. Nicotine sulphate should never be applied to leafy plants that are to be used as food because the spray leaves a poisonous residue. In such cases, substitute pyrethrum extracts or some other non-poisonous spray material.

Root aphids can be eradicated by mixing fresh tobacco dust with an equal portion of lime and working this mixture in around the roots of the infested plants.

In the February, 1940, issue of the Garden BULLETIN we will discuss: Mealy Bugs—Plant Pest No. 2.

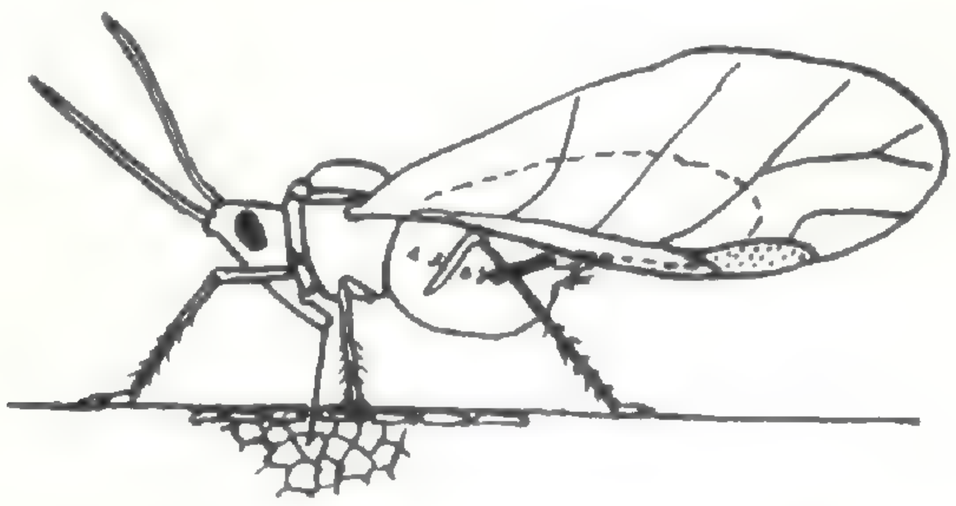


Fig. 3. Aphid extracting plant juices from leaf.

D. C. F.

NEW COURSE ON THE ORGANIZATION AND JUDGING OF FLOWER SHOWS

At the request of the organization committee for the amateur division of the 1940 St. Louis Flower and Garden Show, the Missouri Botanical Garden will sponsor a course on the organization and judging of flower shows, to be given in the Museum building (Tower Grove and Cleveland Avenues), on Tuesday and Wednesday, January 23 and 24, 1940. The Garden has been fortunate in securing Mrs. Ethel Anson S. Peckham of New York, nationally known authority on the subject. Mrs. Peckham will give the following lectures:

Tuesday, January 23, 10:30 a. m.

Organizing and Judging Flower Shows.—This covers all the important points in connection with duties of committees, judges and exhibitors, with explanations on how to avoid and overcome the pitfalls likely to be encountered. Special attention is given to schedules, scales of points, rules, definitions, etc.

Tuesday, January 23, 2:00 p. m.

Judging the Flower Show.—Covers all types of judging with especial emphasis upon cultural classes and special features such as gardens, groups of plants, etc.

Wednesday, January 24, 10:30 a. m.

Flower Arrangement.—Principles of design, together with discussion of receptacles and their uses, also various styles of arrangement, practical arrangement and its purpose, arrangement in the show and home, etc.

Wednesday, January 24, 2:00 p. m.

Judging Flower Arrangements.—Judging various styles, classes, explained and amplified, with a summation of general judging as applied to arrangement and critical appreciation of the same.

Each lecture lasts one hour and twenty-five minutes, with a half hour for questions. Members of the Garden staff will supplement the discussion.

Registration for the entire course (single lectures may not be selected) must be made by January 15, accompanied by the fee of $5.00. Make checks payable to the Missouri Botanical Garden.

NOTES

The November number of *Real Gardening* (**2**:51-53) contains an article "Pickle Worm," by Dr. Edgar Anderson, Geneticist to the Garden.

Mr. L. P. Jensen, Manager of the Garden Arboretum, has been reelected president of the Henry Shaw Gardenway Association. He has also been appointed on the Committee of Arboretums and Botanic Gardens of the American Institute of Park Executives.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, spoke before the St. John Nepomuk Holy Name Society, November 28, on "Along the Cactus Trail"; and before the St. Louis Horticultural Society, December 1, on "Cactus—Indoors and Out."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has an article in the December number of *Desert Plant Life* (**11**:185-186), entitled "Cincinnati Opens a New Desert House";

and one in the December number of *Garden Life* (12:93) on "Winter Care of Succulents."

A paper by Mr. William L. Brown, graduate student at the Garden, entitled "Chromosome Complements of Five Species of Poa, with an Analysis of Variation in *Poa pratensis*," has appeared in the November number of *American Journal of Botany* (26:717-723).

Recent visitors to the Garden library include Mr. Richard Gnade, graduate student, Harvard University; Mr. Neil E. Gordon and Julian F. Smith, of Central College, Fayette, Mo.; Mr. James Bible, Superintendent of City Parks, Denver, Colo.; Dr. Paul C. Mangelsdorf, Assistant Director, Texas Agricultural Experiment Station, College Station; Dr. Ernst Abbe, Assistant Professor of Botany, University of Minnesota, Minneapolis; Mr. Thomas M. Little, Geneticist for W. Atlee Burpee Seed Co., Lompoc, Calif.

STATISTICAL INFORMATION FOR NOVEMBER, 1939

GARDEN ATTENDANCE:

Total number of visitors	46,673

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	5
Total number of books and pamphlets donated	18

PLANT ACCESSIONS:

Total number of plants received	44

HERBARIUM ACCESSIONS:

By Purchase—

Skutch, Alexander F.—Plants of Ecuador	124
Verdoorn, Fr.—"Musci Selecti Critici," Ser. VII, Nos. 301-350 inclusive	50
Williams, L. O.—Orchids of Mexico	100

By Exchange—

Happeman, H.—Plants, chiefly from central United States	102
Marshall College, by F. A. Gilbert—Plants of West Virginia	100
University of Oklahoma—Plants of Oklahoma	91

By Gift—

Anderson, Edgar—Plants of Illinois and of horticulture	22
Cutler, Hugh C.—Fruit, seeds, fragments, and color sketches of plants of New Mexico and Utah	5

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Hubricht, Leslie—Plants of Illinois and of horticulture.....	7
Little, Elbert L., Jr.—*Senecio franciscanus* Greene from Arizona	1
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